

**LA-UR-21-25002**

Approved for public release; distribution is unlimited.

**Title:** International Interlaboratory Compilation of Trace Element Concentrations in the CUP-2 Uranium Ore Concentrate Standard

**Author(s):** Denton, J. S.; Saull, P.R.B.; Bostick, D.A.; Boulyga, S.F.; Cunningham, J.A.; Dimayuga, I.; Hexel, C.R.; Hiess, J.; Jovanovic, S.; Kaye, P.; Kell, T.; Kelly, F.; Kinman, W.; Kiser, S.; Lindvall, R.E.; Macsik, Z.; Manard, B.; Mayer, K.; Mercier, J.-F.; Samuleev, P.; Shi, Y.; et al.

**Intended for:** Report

---

**Issued:** 2021-08-31 (rev.1)

**Disclaimer:**

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by Triad National Security, LLC for the National Nuclear Security Administration of U.S. Department of Energy under contract 89233218CNA000001. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

# **International Interlaboratory Compilation of Trace Element Concentrations in the CUP-2 Uranium Ore Concentrate Standard**

J. S. Denton<sup>1</sup>, P.R.B. Saull<sup>2</sup>, D.A. Bostick<sup>10</sup>, S. F. Boulyga<sup>12</sup>, J. A. Cunningham<sup>12</sup>, I. Dimayuga<sup>4</sup>, C.R. Hexel<sup>10</sup>, J. Hiess<sup>12</sup>, S. Jovanovic<sup>5</sup>, P. Kaye<sup>3</sup>, T. Kell<sup>5</sup>, F. Kelly<sup>11</sup>, W. Kinman<sup>1</sup>, S. Kiser<sup>6</sup>, R. E. Lindvall<sup>8</sup>, Z. Macsik<sup>12,1,a</sup>, B. Manard<sup>9,10,b</sup>, K. Mayer<sup>7</sup>, J.-F. Mercier<sup>6</sup>, P. Samuleev<sup>11</sup>, Y. Shi<sup>4</sup>, B.W. Ticknor<sup>10</sup>, M. Totland<sup>4</sup>, Z. Varga<sup>7</sup>, M. Wallenius<sup>7</sup>, M. Wylie<sup>9</sup>

<sup>1</sup>Nuclear and Radiochemistry Group, Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM 87545, USA.

<sup>2</sup>National Research Council Canada, Ionizing Radiation Standards, 1200 Montreal Road, M-35, Ottawa, ON K1A 0R6, Canada.

<sup>3</sup>AWE, Aldermaston, RG7 4PR, UK.

<sup>4</sup>Canadian Nuclear Laboratories, 286 Plant Rd, Chalk River, ON K0J 1J0, Canada.

<sup>5</sup>Canadian Nuclear Safety Commission Laboratory, 3484 Limebank Rd, Ottawa, ON K1V 1E1, Canada.

<sup>6</sup>National Monitoring Section, Radiation Protection Bureau, Health Canada, 775 Brookfield Road, Ottawa, ON K1A 1C1.

<sup>7</sup>European Commission, Joint Research Centre (JRC), Directorate for Nuclear Safety and Security, P.O. Box 2340, 76125 Karlsruhe, Germany.

<sup>8</sup>Nuclear and Chemical Sciences Division, Physical and Life Sciences Directorate, Lawrence Livermore National Laboratory, 7000 East Avenue, Livermore, CA 94551, USA.

<sup>9</sup>Actinide Analytical Chemistry Group, Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM 87545, USA.

<sup>10</sup>Chemical Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830, USA.

<sup>11</sup>Analytical Sciences Group and the SLOWPOKE-2 Facility, Department of Chemistry and Chemical Engineering, Royal Military College of Canada, PO Box 17000, Station Forces, Kingston, ON K7K 7B4 Canada.

<sup>12</sup>Department of Safeguards, International Atomic Energy Agency, PO Box 100, 1400 Vienna, Austria.

<sup>a</sup>work performed at <sup>12</sup> but now at <sup>1</sup>.

<sup>b</sup>work performed at <sup>9</sup> but now at <sup>10</sup>

## **Abstract**

The accurate and precise analysis of impurities in uranium ore concentrates is an important aspect of nuclear forensics. Defensibility of analytical data requires the use of analytical reference materials as part of quality control. This report presents a compilation of the results of trace element concentration measurements of the CUP-2 Uranium Ore Concentration Standard from 11 different laboratories. Various dissolution methods, instrumental platforms, and analytical methods were employed. The resulting data set contains concentration of 66 impurities with up to 139 individual data points for each impurity. Consensus values have been assigned to each impurity following a statistical analysis of the data set.

## **1. Introduction**

This report contains a compilation of trace element data measured in the uranium ore concentrate (UOC) reference material CUP-2. CUP-2 was blended by the Government of Canada's Department of Natural Resources Canadian Certified Reference Materials Project from material provided by the Blind River Refinery of Eldorado Resources Ltd in 1986. The standard is certified for uranium concentration and there are recommended values for 16 other analytes (moisture, S, Si, Ti, Ca, V, As, Zr, B, Fe, Ni, Na,

Mo, Mg, K, P) but without stated uncertainty (CUP-2 Certificate of Analysis, Dalton and Bowman, 1988).

The accurate and precise analysis of impurities in UOCs is an important aspect of nuclear forensics. The CUP-2 standard has been widely used as a quality control standard when analyzing UOCs and a detailed analytical investigation was performed by Eppich et al. (2016). CUP-2 also has relatively high concentrations of the rare earth elements (REEs), often a key signature for nuclear forensics investigations (Varga et al., 2010a, Varga et al., 2010b), but these are not detailed in the original certificate. Moreover, the certificate recommended values without assigned uncertainties are not meaningful. Consequently, in February 2016 at the Technical Meeting on Analysis of Elemental Impurities in Uranium Samples for Safeguards at the IAEA it was decided that an informal interlaboratory comparison exercise would be performed to determine consensus values for the CUP-2 UOC standard for elements such as the REEs. Due to the informal nature of the exercise no formal distribution or analyses protocols were designed. Instead, laboratories purchased their own supplies and used established measurement protocols. Laboratories reported the majority of the elements of the periodic table including those detailed in the original certificate as well as the REEs. A summary of the results are presented in this report with the detailed data provided in the appendices.

## 2. Participating laboratories

Table 1 contains the participating laboratories and countries. Each laboratory was provided a unique identifying number that bore no resemblance to alphabetical order. The identifying number was kept confidential.

**Table 1.** Participating laboratories and countries.

Laboratory	Country
Atomic Weapons Establishment (AWE)	United Kingdom
Canadian Nuclear Laboratories (CNL) <sup>a</sup>	Canada
Canadian Nuclear Safety Commission (CNSC)	Canada
Health Canada (HC)	Canada
Joint Research Centre (JRC)	European Commission
Lawrence Livermore National Laboratory (LLNL)	United States of America
Los Alamos National Laboratory (LANL): Actinide Analytical Chemistry Group, C-AAC	United States of America
Los Alamos National Laboratory (LANL): Nuclear and Radiochemistry Group, C-NR	United States of America
Oak Ridge National Laboratory (ORNL)	United States of America
Royal Military College of Canada (RMC)	Canada
Safeguards Analytical Services Laboratory (SGAS)	IAEA, Vienna

<sup>a</sup>operating as Atomic Energy of Canada Limited at time of the intercomparison

## 3. Methods

Laboratories performed trace element analysis by their respective established protocols, detailed in Table 2. Twelve laboratories provided results for this compilation, however during the internal data review (described below), laboratory two requested to remove their data. Therefore no method information is provided for laboratory 2.

**Table 2.** Summary of analytical methods used by each laboratory to analyze the trace element composition of CUP-2.

Laboratory	Dissolution	Instrument	Analytical Method	U method	Standards
1	Hot plate/block heater method - 6 mL 16 M HNO <sub>3</sub> heated at 90 °C for 6 hours. Diluted to 15 mL with 15% HNO <sub>3</sub> . 50 mg dissolved	Thermo Element 2 HF Sector Field ICP-MS	Non-matrix matched external calibration. Indium internal standard used for drift correction	Davies and Gray	Non-matrix matched standards from SPEX CertiPrep CLMS 1-4 standard blends. U matrix limited to 50-75 ppm where signal suppression compensated by internal standardization. In house well-characterized UOC (Rio Algom) from Springfields collection run as a QC standard.
3	Microwave digestion with Aqua Regia	Single quadrupole ICP-MS (Agilent 7700x) with the reaction cell. Used No Gas mode (no reaction cell) for Li, Be, Na, Al, Mg, P and S; [H2]- mode for Ca, Ga, Ge, Sc and Se, and [He] mode for all other reported	Internal standard method (In)	Concentration of uranium was determined by ICP-MS in more diluted solution, to bring the concentration of U to within the calibration range, i.e. less than 400 microg/L.	Used external calibration with NIST traceable standards, non matrix-matched. The validity of the calibration was checked with NIST 1640a. The digestion was run with digestion blank as the QC sample. The accuracy of measurement of certain elements was verified by the standard addition method.
4	Microwave (Cetac Discover) – 8M HNO <sub>3</sub> + trace HF	Thermo Scientific Element 2	Matrix-matched (100 ppm U) external calibration (6 point) with internal standard (In).	Davies and Gray titration prior to dilution	Twenty Inorganic ventures custom solutions for external calibration. Previous UOC round robin standards as well as CRM 124 series used as QC standards.
5	Microwave digestion with nitric acid and HF	Thermo XSeries Q-ICP-MS	Matrix-matched (100 ppm U) external calibration with Indium internal standard used for drift correction.	A separate preparation of the solution was measured by ICP-OES	Inorganic Ventures custom Multi-Element Solutions for external calibration. NBL 124 series used for QC certified reference materials.
6	Hot plate method – 8M HNO <sub>3</sub> + trace HF. Dissolved 300 mg	Element2 Sector-field ICP-MS	Matrix-matched (100 ppm U) spiked gravimetrically with multi-element standards. Rh used as internal standard.	Measured by TIMS	Matrix-matched standards, Perkin Elmer for calibration and Inorganic Ventures multi-element mixture for QC.
7	Microwave with nitric acid, hydrochloric acid, perchloric acid, sodium peroxide.	Bruker 820 Magnetic Sector ICP-MS	Non matrix-matched external calibration with the following internal standards (Sc, Y, In, Bi)	Measured with trace elements	Multi-element standards and Li single element standard from Inorganic Ventures. ICP-MS multi-element standard solutions from SpexCertiPrep and Inorganic Ventures used as independent verification standards. NBL CRM 241-1 24 Element Impurity standard was used as QC standard.

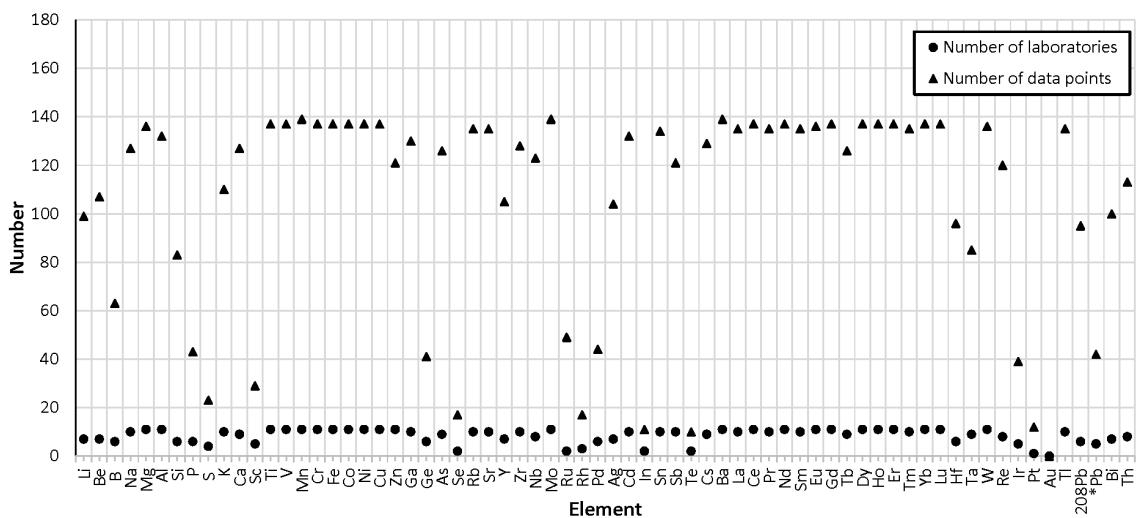
8	Microwave (MARS Xpress) with HNO <sub>3</sub> + trace HF	ICP-MS ELAN DRCII (Perkin Elmer)	Non matrix-matched external calibration with the following internal standards (Li, Sc, Y, Rh, In, Bi)	Measured with trace elements	Inorganic Ventures Multi-Element Mixtures with Lot numbers different from Calibration standards were used as calibration controls
9	Microwave (CEM Discovery) with HNO <sub>3</sub> and HCl	Thermo Finnigan Element 2 ICP-MS	Non matrix-matched external calibration with the following internal standards (Sc, In, Rh, Ge)	Measured with trace elements	High Purity Standard Part #ICP-MS-68A multi element standard in three separate bottles. Environment Canada Trace Elements sample for QC.
10	Microwave oven with HNO <sub>3</sub>	Thermo Element 2 ICPMS with magnetic sector	Matrix-matched external calibration with 100 ppm U from CRM 112-A and internal normalization to <sup>235</sup> U.		Claritas PPT Grade Multi-Element Solutions, SPEX CertiPrep used for external calibration. CETAMA Morille and Chanterelle, NBL 124 series used for QC reference materials.
11	Hot plate using HNO <sub>3</sub> and HF	Thermo Element XR Magnetic sector ICP-MS	External calibration with matrix-matching	Independent measurement	Matrix-matched external calibration standards
12	Hot block in sealed Teflon vessels. 8M HNO <sub>3</sub> with trace HF.	Quadrupole ICP-MS and ICP-OES.	External calibration	Davies and Gray	Matrix-matched calibration standards with internal standard.

The results were compiled and where necessary converted from parts per million to  $\mu\text{g/g}$  uranium. Data were discarded if (i) they were not greater than the laboratory reported lower limit of detection, and (ii) the data minus the reported expanded uncertainty (coverage factor of two,  $k=2$ ) was not greater than zero. The resulting compilation was sent to participating laboratories and a data review was undertaken where some laboratories chose to remove some of their results. The results shown and described below are all following this data review.

#### 4. Results

The number of laboratories contributing data for each element varies from 1 to 11 and the number of data points per element varies from 10 to 139. Both are shown graphically in Figure 1. Table 3 shows the number of contributing laboratories, number of data points, the mean results and uncertainties for each element reported. The full data set for each element can be found in the accompanying appendices in Tables A1-A66 and Figures A1-A66 (results for laboratory 2 are omitted). Figures A1-A66 also contain the various averages computed in this study, the methodology of which is discussed in Section 5. Apart from moisture (not analyzed) and sulfur there is a large data set (at least 63 results for each element) from a broad number of laboratories (a minimum of six for each element) for all the elements in the original certificate, with the results from this compilation consistent with the original recommended values within analytical uncertainty (Figures A1-A66). The data set reported here for the REEs (Lanthanum to Lutetium excluding Promethium) is also extensive with 9+ laboratories reporting for all REEs and at least 135 data points for each REE.

Two populations of Pb are evident in Figure A64. CUP-2 has a large contribution of radiogenic lead (S. Jovanovic pers. comm., W. Kinman, pers. comm.) so normalizing a  $^{208}\text{Pb}$  measurement to total Pb using natural isotopic abundances is not appropriate. The population with a concentration of  $\sim 100 \mu\text{g/g}$  U are from laboratories that reported  $^{208}\text{Pb}$  only. The population with a concentration of  $\sim 350 \mu\text{g/g}$  U are from laboratories that measured the isotopic composition of Pb and summed total Pb based on the isotopic measurement. In Table 3 and subsequent figures and tables the Pb results are split between  $^{208}\text{Pb}$  and  $^*\text{Pb}$  with the  $^*$  signifying total Pb as detailed in the table footnotes.



**Figure 1.** Graph showing the number of laboratories contributing data (black circles) and the number of data points (black triangles) for each element.

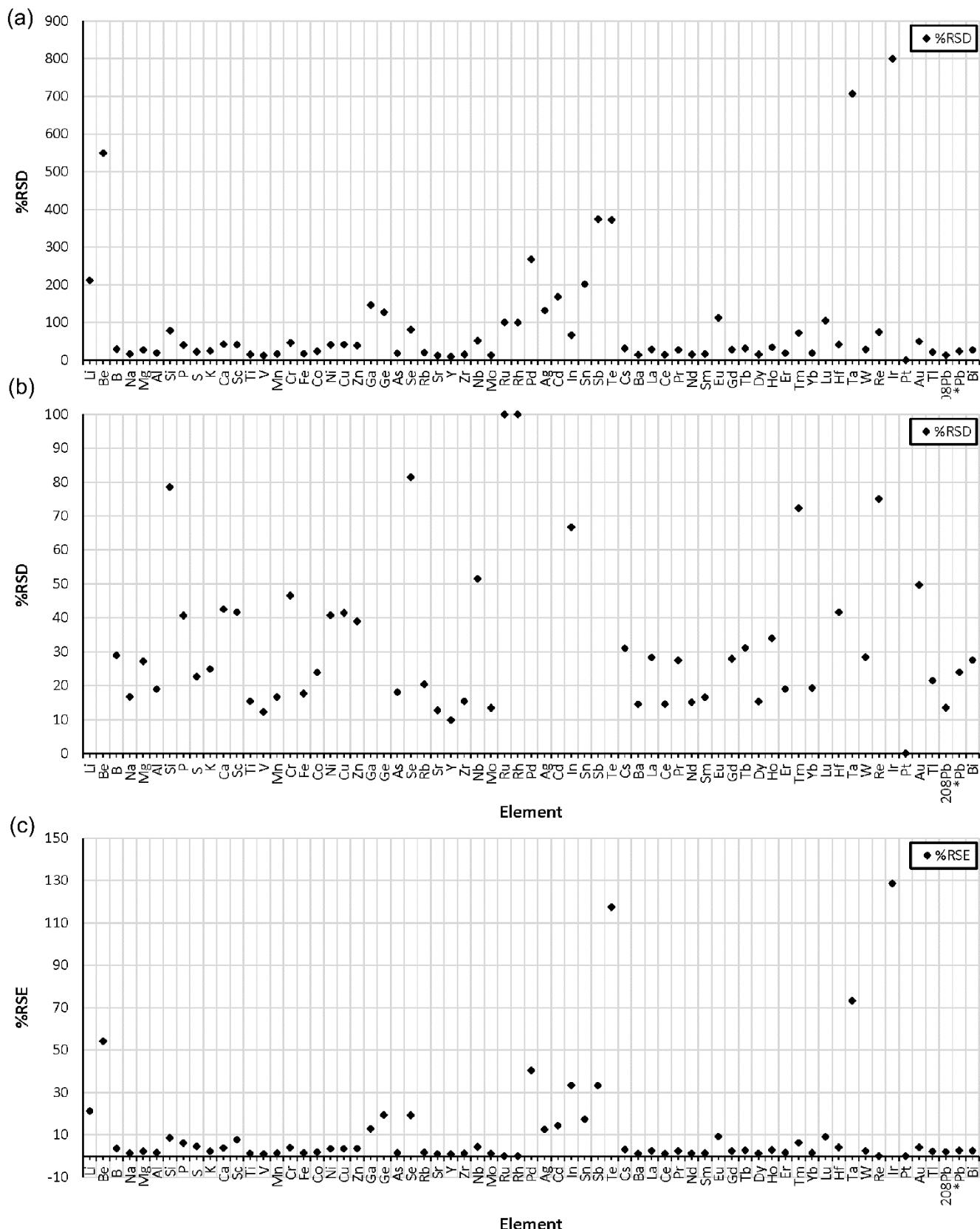
**Table 3.** Summary results of each element analyzed in CUP-2. Tabulated are the number of contributing laboratories, the number of analyses, the mean, standard deviation, and standard error for each element. Also shown is the relative uncertainty as a percentage. The calculated mean, uncertainties and %RSD and %RSE are reported to two decimal places. This decision was based on the majority of laboratories reporting results between zero and four decimal places depending on the element. Uncertainties are reported with a coverage factor of two ( $k=2$ ). Where a value is <0.01 the result was greater than zero but not when expressed to two decimal places. Consequently the %RSD or %RSE cannot be represented so <100.00 is reported.

Element	Number of contributing laboratories	Number of Analyses	Mean	Standard Deviation ( $k=2$ )	%RSD	Standard Error ( $k=2$ )	%RSE
Li	7	99	1.69	3.58	211.83	0.36	21.30
Be	7	107	0.48	2.64	550.00	0.26	54.17
B	6	63	77.15	22.31	28.92	2.81	3.64
Na	10	127	6070.79	1013.72	16.70	89.95	1.48
Mg	11	136	3231.63	878.28	27.18	75.31	2.33
Al	11	132	3272.47	621.46	18.99	54.09	1.65
Si	6	83	2198.31	1726.91	78.56	189.55	8.62
P	6	43	346.87	140.95	40.63	21.50	6.20
S	4	23	10582.98	2394.38	22.62	499.26	4.72
K	10	110	1497.78	372.96	24.90	35.56	2.37
Ca	9	127	8184.19	3484.52	42.58	309.20	3.78
Sc	5	29	6.81	2.84	41.70	0.53	7.78
Ti	11	137	225.40	34.75	15.42	2.97	1.32
V	11	137	886.35	108.66	12.26	9.28	1.05
Mn	11	139	134.36	22.36	16.64	1.90	1.41
Cr	11	137	20.03	9.32	46.53	0.80	3.99
Fe	11	137	4412.27	779.82	17.67	66.62	1.51
Co	11	137	3.09	0.74	23.95	0.06	1.94
Ni	11	137	35.52	14.47	40.74	1.24	3.49
Cu	11	137	32.22	13.34	41.40	1.14	3.54
Zn	11	121	45.93	17.90	38.97	1.63	3.55
Ga	10	130	0.62	0.91	146.77	0.08	12.90
Ge	6	41	0.67	0.85	126.87	0.13	19.40
As	9	126	443.77	80.43	18.12	7.17	1.62
Se	2	17	1.24	1.01	81.45	0.24	19.35
Rb	10	135	10.19	2.08	20.41	0.18	1.77
Sr	10	135	70.77	9.00	12.72	0.77	1.09
Y	7	105	99.38	9.79	9.85	0.96	0.97
Zr	10	128	558.69	85.92	15.38	7.59	1.36
Nb	8	123	0.68	0.35	51.47	0.03	4.41
Mo	11	139	1020.02	137.46	13.48	11.66	1.14
Ru	2	49	0.01	0.01	100.00	<0.01	<100.00
Rh	3	17	0.01	0.01	100.00	<0.01	<100.00
Pd	6	44	6.42	17.20	267.91	2.59	40.34

<b>Ag</b>	7	104	1.50	1.98	132.00	0.19	12.67
<b>Cd</b>	10	132	1.46	2.46	168.49	0.21	14.38
<b>In</b>	2	11	0.03	0.02	66.67	0.01	33.33
<b>Sn</b>	10	134	5.75	11.60	201.74	1.00	17.39
<b>Sb</b>	10	121	0.27	1.01	374.07	0.09	33.33
<b>Te</b>	2	10	1.83	6.81	372.13	2.15	117.49
<b>Cs</b>	9	129	1.29	0.40	31.01	0.04	3.10
<b>Ba</b>	11	139	145.50	21.13	14.52	1.79	1.23
<b>La</b>	10	135	24.41	6.91	28.31	0.59	2.42
<b>Ce</b>	11	137	53.43	7.78	14.56	0.66	1.24
<b>Pr</b>	10	135	6.66	1.83	27.48	0.16	2.40
<b>Nd</b>	11	137	26.51	4.01	15.13	0.34	1.28
<b>Sm</b>	10	135	12.55	2.08	16.57	0.18	1.43
<b>Eu</b>	11	136	1.09	1.22	111.93	0.10	9.17
<b>Gd</b>	11	137	20.72	5.78	27.90	0.49	2.36
<b>Tb</b>	9	126	4.11	1.28	31.14	0.11	2.68
<b>Dy</b>	11	137	25.07	3.84	15.32	0.33	1.32
<b>Ho</b>	11	137	4.53	1.54	34.00	0.13	2.87
<b>Er</b>	11	137	11.84	2.25	19.00	0.19	1.60
<b>Tm</b>	10	135	1.59	1.15	72.33	0.10	6.29
<b>Yb</b>	11	137	9.39	1.81	19.28	0.15	1.60
<b>Lu</b>	11	137	1.21	1.27	104.96	0.11	9.09
<b>Hf</b>	6	96	0.48	0.20	41.67	0.02	4.17
<b>Ta</b>	9	85	0.15	1.06	706.67	0.11	73.33
<b>W</b>	11	136	17.99	5.11	28.40	0.44	2.45
<b>Re</b>	8	120	0.04	0.03	75.00	<0.01	<100.00
<b>Ir</b>	5	39	0.07	0.56	800.00	0.09	128.57
<b>Pt</b>	1	12	0.01	<0.01	<100.00	<0.01	<100.00
<b>Tl</b>	10	135	4.95	2.46	49.70	0.21	4.24
<b><sup>208</sup>Pb</b>	6	95	113.93	24.50	21.50	2.51	2.20
<b>*Pb</b>	5	42	357.32	48.25	13.50	7.45	2.08
<b>Bi</b>	7	100	1.92	0.46	23.96	0.05	2.60
<b>Th</b>	8	113	2173.17	598.55	27.54	56.31	2.59

\*these Pb results were calculated using the data reported from laboratories that summed total Pb based on their isotopic composition measurement.

The percent relative standard deviation (%RSD, k=2) varies from 9.85% to 800.00% (Table 3) and is plotted for each element in Figure 2a and b. The percent relative standard error (%RSE, k=2) varies from 0.97% to 128.57% (Table 3) and is plotted in Figure 2c. The %RSD values are significantly higher for most elements than the %RSE values indicating that there is variability in the concentration of each element between the samples analyzed by different laboratories.



**Figure 2.** Graphs showing percent relative standard deviation (%RSD) (a) in full and (b) values less than or equal to 100% for each element. Plot (c) shows all %RSE values. The %RSD is large for most elements suggesting variability in these elements between CUP-2 samples. The %RSE is lower, often <10% suggesting that the mean is a reasonable estimate of the true value for this population. Where a value is listed in Table 3 as <100.00 it is plotted here as zero.

## **5. Statistical treatment of data**

The %RSE values for most elements are <10% indicating that the mean value is likely to be a reasonable estimate of the true value of the population in this compilation. The %RSD values are however significantly higher indicating that there is a large degree of variability in the concentrations of each element between the samples analyzed by different laboratories. For CUP-2 to be used as a quality control material, any elemental consensus value with associated uncertainty must take this variability between the CUP-2 units analyzed by different laboratories into account. The data plots for each element (A1 to A66) allow a visual assessment of whether this variability is due to sample heterogeneity (results from individual laboratories being different to other laboratories e.g. Er) or outliers (individual data points that are different from the consensus e.g. Tb). Standard assessments of the presence of outliers require either a determination that there is one outlier e.g. Chauvenet's criterion/Grubbs' test, or multiple outliers (e.g. Thompson Tau or Tietjen-Moore test). Since the proportion of suspected outliers varies from element to element, two approaches of controlling for outliers were employed. The first was to take the simplistic approach of removing all data that was greater than or less than two standard deviations of the original mean. A new mean and standard deviation was then calculated and termed 'mean after outliers rejected'. The second approach was the 'robust statistics' approach detailed in the 2001 Analytical Methods Committee (AMC) technical brief. This method "summarizes results when we suspect that they include a small proportion of outliers" and "provides a model describing the 'good' part of the data, but does not require us to identify specific observations as outliers". Firstly the median for each data set is taken as a robust estimate of the average value and termed  $\hat{\mu}$ . The robust standard deviation ( $\hat{\sigma}$ ) is estimated by multiplying the median absolute difference (MAD) between the values and the median by 1.5. The mean and standard deviations with and without outlier rejection as well as the median and robust standard deviation are shown in Table 4.

**Table 4.** Average results for each element following three separate statistical treatments: (i) mean without outlier rejection, (ii) mean after data greater or less than 2 standard deviations rejected, and (iii) robust statistics of mean and robust standard deviation. All results and uncertainties are reported to two decimal places. Where a value is <0.01 the result was greater than zero but not when expressed to two decimal places. Consequently the %RSD or %RSE cannot be represented so <100.00 is reported.

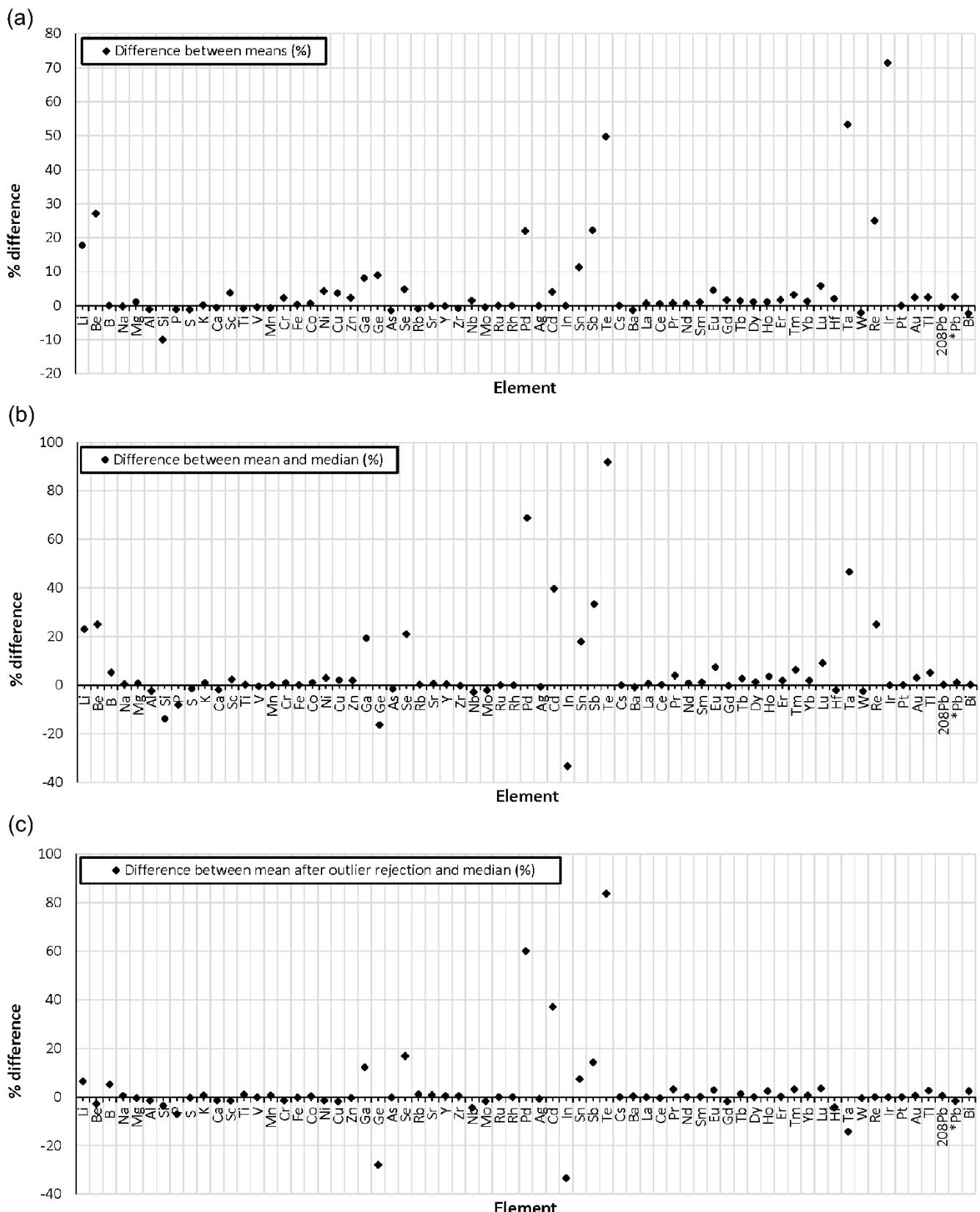
Element	No outlier rejection				Outlier rejected				Robust Statistics			
	N	$\bar{x}$	$\sigma$ (k=2)	%RSD	N	$\bar{x}$	$\sigma$ (k=2)	%RSD	N	$\hat{\mu}$	$\hat{\sigma}$	%RSD
<b>Li</b>	99	1.69	3.58	211.83	96	1.39	0.92	66.19	99	1.30	0.20	15.38
<b>Be</b>	107	0.48	2.64	550.00	106	0.35	0.17	48.57	107	0.36	0.09	25.00
<b>B</b>	63	77.15	22.31	28.92	63	77.15	22.31	28.92	63	73.14	24.77	33.87
<b>Na</b>	127	6070.79	1013.72	16.70	123	6080.36	860.20	14.15	127	6050.01	872.15	14.42
<b>Mg</b>	136	3231.63	878.28	27.18	130	3193.94	493.75	15.46	136	3205.49	498.48	15.55
<b>Al</b>	132	3272.47	621.46	18.99	124	3307.28	510.44	15.43	132	3354.90	390.54	11.64
<b>Si</b>	83	2198.31	1726.91	78.56	71	2417.68	711.10	29.41	83	2502.92	798.51	31.90
<b>P</b>	43	346.87	140.95	40.63	42	350.49	134.31	38.32	43	375.12	109.79	29.27
<b>S</b>	23	10582.98	2394.38	22.62	22	10700.39	2162.75	20.21	23	10734.94	1780.12	16.58
<b>K</b>	110	1497.78	372.96	24.90	106	1494.68	300.90	20.13	110	1484.42	240.31	16.19
<b>Ca</b>	127	8184.19	3484.52	42.58	122	8228.83	2129.51	25.88	127	8342.90	1572.64	18.85
<b>Sc</b>	29	6.81	2.84	41.70	28	6.55	0.67	10.23	29	6.65	0.72	10.83
<b>Ti</b>	137	225.40	34.75	15.42	128	227.18	27.47	12.09	137	224.93	20.43	9.08
<b>V</b>	137	886.35	108.66	12.26	128	890.03	84.10	9.45	137	890.46	80.60	9.05
<b>Mn</b>	139	134.36	22.36	16.64	131	135.24	18.34	13.56	139	134.26	17.40	12.96
<b>Cr</b>	137	20.03	9.32	46.53	135	19.57	3.99	20.39	137	19.84	2.44	12.30
<b>Fe</b>	137	4412.27	779.82	17.67	127	4396.74	619.23	14.08	137	4408.62	597.36	13.55
<b>Co</b>	137	3.09	0.74	23.95	131	3.07	0.46	14.98	137	3.06	0.41	13.40
<b>Ni</b>	137	35.52	14.47	40.74	127	34.00	8.59	25.26	137	34.46	4.74	13.76
<b>Cu</b>	137	32.22	13.34	41.40	130	31.03	8.32	26.81	137	31.58	5.69	18.02
<b>Zn</b>	121	45.93	17.90	38.97	117	44.87	13.63	30.38	121	45.02	14.93	33.16
<b>Ga</b>	130	0.62	0.91	146.77	128	0.57	0.32	56.14	130	0.50	0.07	14.00
<b>Ge</b>	41	0.67	0.85	126.87	39	0.61	0.68	111.48	41	0.78	0.72	92.31
<b>As</b>	126	443.77	80.43	18.12	118	450.09	65.74	14.61	126	450.68	61.56	13.66
<b>Se</b>	17	1.24	1.01	81.45	16	1.18	0.89	75.42	17	0.98	0.40	40.82
<b>Rb</b>	135	10.19	2.08	20.41	123	10.28	1.34	13.04	135	10.17	1.50	14.75
<b>Sr</b>	135	70.77	9.00	12.72	123	70.85	6.39	9.02	135	70.32	7.08	10.07
<b>Y</b>	105	99.38	9.79	9.85	99	99.48	7.24	7.28	105	99.01	7.05	7.12
<b>Zr</b>	128	558.69	85.92	15.38	117	562.81	66.36	11.79	128	560.20	60.60	10.82
<b>Nb</b>	123	0.68	0.35	51.47	122	0.67	0.29	43.28	123	0.70	0.31	44.29
<b>Mo</b>	139	1020.02	137.46	13.48	131	1024.68	113.20	11.05	139	1041.57	84.42	8.11
<b>Ru</b>	49	0.01	0.01	100.00	45	0.01	0.01	100.00	49	0.01	0.01	100.00
<b>Rh</b>	17	0.01	0.01	100.00	17	0.01	0.01	100.00	17	0.01	0.02	200.00
<b>Pd</b>	44	6.42	17.20	267.91	41	5.01	14.09	281.24	44	2.00	2.52	126.00
<b>Ag</b>	104	1.50	1.98	132.00	104	1.50	1.98	132.00	104	1.51	3.11	205.96
<b>Cd</b>	132	1.46	2.46	168.49	129	1.40	2.33	166.43	132	0.88	1.45	164.77

<b>In</b>	11	0.03	0.02	66.67	11	0.03	0.02	66.67	11	0.04	0.01	25.00
<b>Sn</b>	134	5.75	11.60	201.74	132	5.10	4.89	95.88	134	4.72	0.51	10.81
<b>Sb</b>	121	0.27	1.01	374.07	119	0.21	0.27	128.57	121	0.18	0.07	38.89
<b>Te</b>	10	1.83	6.81	372.13	9	0.92	3.89	422.83	10	0.15	0.25	166.67
<b>Cs</b>	129	1.29	0.40	31.01	117	1.29	0.25	19.38	129	1.29	0.13	10.08
<b>Ba</b>	139	145.50	21.13	14.52	127	147.33	14.11	9.58	139	146.73	11.04	7.52
<b>La</b>	135	24.41	6.91	28.31	132	24.24	6.63	27.35	135	24.26	7.08	29.18
<b>Ce</b>	137	53.43	7.78	14.56	125	53.14	5.20	9.79	137	53.36	4.61	8.64
<b>Pr</b>	135	6.66	1.83	27.48	134	6.61	1.31	19.82	135	6.40	0.56	8.75
<b>Nd</b>	137	26.51	4.01	15.13	125	26.33	2.74	10.41	137	26.31	2.20	8.36
<b>Sm</b>	135	12.55	2.08	16.57	128	12.42	1.51	12.16	135	12.40	0.97	7.82
<b>Eu</b>	136	1.09	1.22	111.93	135	1.04	0.24	23.08	136	1.01	0.08	7.92
<b>Gd</b>	137	20.72	5.78	27.90	128	20.39	4.43	21.73	137	20.76	3.64	17.53
<b>Tb</b>	126	4.11	1.28	31.14	124	4.05	0.69	17.04	126	4.00	0.30	7.50
<b>Dy</b>	137	25.07	3.84	15.32	125	24.79	2.22	8.96	137	24.77	1.95	7.87
<b>Ho</b>	137	4.53	1.54	34.00	136	4.48	0.85	18.97	137	4.37	0.48	10.98
<b>Er</b>	137	11.84	2.25	19.00	128	11.64	1.26	10.82	137	11.61	0.91	7.84
<b>Tm</b>	135	1.59	1.15	72.33	134	1.54	0.30	19.48	135	1.49	0.13	8.72
<b>Yb</b>	137	9.39	1.81	19.28	130	9.27	1.17	12.62	137	9.21	0.96	10.42
<b>Lu</b>	137	1.21	1.27	104.96	134	1.14	0.23	20.18	137	1.10	0.09	8.18
<b>Hf</b>	96	0.48	0.20	41.67	94	0.47	0.13	27.66	96	0.49	0.07	14.29
<b>Ta</b>	85	0.15	1.06	706.67	83	0.07	0.05	71.43	85	0.08	0.02	25.00
<b>W</b>	136	17.99	5.11	28.40	124	18.37	3.58	19.49	136	18.44	2.86	15.51
<b>Re</b>	120	0.04	0.03	75.00	110	0.03	0.01	33.33	120	0.03	0.01	33.33
<b>Ir</b>	39	0.07	0.56	800.00	38	0.02	0.11	550.00	39	<0.01	<0.01	<100.00
<b>Pt</b>	12	0.01	<0.01	<100.00	12	0.01	<0.01	<100.00	12	0.01	<0.01	<100.00
<b>Tl</b>	135	4.95	2.46	49.70	133	4.83	1.27	26.29	135	4.80	0.81	16.88
<b><sup>208</sup>Pb</b>	95	113.93	24.50	21.50	87	111.14	16.62	14.95	95	108.19	14.67	13.56
<b>*Pb</b>	42	357.32	48.25	13.50	41	358.75	45.14	12.58	42	356.59	35.25	9.89
<b>Bi</b>	100	1.92	0.46	23.96	92	1.87	0.28	14.97	100	1.90	0.23	12.11
<b>Th</b>	113	2173.17	598.55	27.54	108	2222.02	374.05	16.83	113	2169.98	243.47	11.22

\*these Pb results were calculated using the data reported from laboratories that summed total Pb based on their isotopic composition measurement.

The percent difference between the means before and after outlier rejection as well as the difference between both means and the median are shown in Figure 3 and Table 5. The range in the percent differences for the different approaches are similar. Difference between the means, the mean and the median, and the mean after outlier rejection and the median range from ~ -10% to ~ 71%, -33% to 92%, and -33% to 84% respectively. The largest % changes are often for the same elements e.g. Ir, Te, Sb indicating that the consensus value for these elements is not reliable since the average changes depending on the statistical technique applied. The average for most of the elements however does not change by more than 10%, which is an equal or smaller change than most of the % relative uncertainties presented in Table 4. The plots of the full data set for each element (Figures A1-A66) also demonstrate that for most elements the three different averages overlap within analytical uncertainty and are a good reflection of the variability in the data.

Due to the possibility of sample heterogeneity as well as the different laboratory methods employed (e.g. microwave vs. hot plate dissolution, use of HF etc) it is challenging to reliably identify how many, if any, outliers are present. The rejection of data greater or less than two standard deviations is likely too simplistic since in a normally distributed sample of 130+ values one would expect to remove between six and seven valid values using this method. Thus the robust statistics approach i.e.  $\hat{\mu}$  and  $\hat{\sigma}$  from Table 4 is considered the best compromise for a consensus value for each element in CUP-2 since the entire data set is retained and used in the calculation. Elements where data from one or more laboratories are not well represented by the median and robust standard deviation include Li, Si, Ni, Cu, Rb, Pd, Sn, Ba, Ce, Dy, Er, Yb, Re. Since all laboratories were: (i) asked to review their data in view of this compilation, and (ii) it is not the same laboratory's data for all elements, this suggests larger variability in the concentration of these elements between CUP-2 samples/units. In contrast the median and robust standard deviation reflects the variation in the data whilst not being as affected by possible outliers as the mean and standard deviation for these elements e.g. Be, Mg, Ca, Sc, Cr, Co, Ga, Sb, Pr, Eu, Tb, Ho, Tm, Lu, Hf, Ta, Ir.



**Figure 3.** The percent difference for each element between (a) the mean before and after outlier rejection, (b) the mean before outlier rejection and the median, and (c) the mean after outlier rejection and the median. The difference for most elements is less than 10% whichever average is used. Where a value is listed in Table 5 as <100.00 it is plotted here as zero.

**Table 5.** The percent difference between the three averages calculated as part of this compilation. In column two the mean after outlier rejection is the numerator. In columns three and four the median is the numerator. All results are reported to two decimal places. Where a value is <100.00 either the numerator or denominator was reported as <0.01 to two decimal places. Consequently the percent difference cannot be represented so <100.00 is reported.

Element	Difference between means (%)	Difference between mean and median (%)	Difference between mean after outlier rejection and median (%)
Li	17.75	23.08	6.47
Be	27.08	25.00	-2.86
B	0.00	5.20	5.20
Na	-0.16	0.34	0.50
Mg	1.17	0.81	-0.36
Al	-1.06	-2.52	-1.44
Si	-9.98	-13.86	-3.53
P	-1.04	-8.14	-7.03
S	-1.11	-1.44	-0.32
K	0.21	0.89	0.69
Ca	-0.55	-1.94	-1.39
Sc	3.82	2.35	-1.53
Ti	-0.79	0.21	0.99
V	-0.42	-0.46	-0.05
Mn	-0.65	0.07	0.72
Cr	2.30	0.95	-1.38
Fe	0.35	0.08	-0.27
Co	0.65	0.97	0.33
Ni	4.28	2.98	-1.35
Cu	3.69	1.99	-1.77
Zn	2.31	1.98	-0.33
Ga	8.06	19.35	12.28
Ge	8.96	-16.42	-27.87
As	-1.42	-1.56	-0.13
Se	4.84	20.97	16.95
Rb	-0.88	0.20	1.07
Sr	-0.11	0.64	0.75
Y	-0.10	0.37	0.47
Zr	-0.74	-0.27	0.46
Nb	1.47	-2.94	-4.48
Mo	-0.46	-2.11	-1.65
Ru	0.00	0.00	0.00
Rh	0.00	0.00	0.00
Pd	21.96	68.85	60.08
Ag	0.00	-0.67	-0.67
Cd	4.11	39.73	37.14
In	0.00	-33.33	-33.33
Sn	11.30	17.91	7.45
Sb	22.22	33.33	14.29
Te	49.73	91.80	83.70
Cs	0.00	0.00	0.00
Ba	-1.26	-0.85	0.41
La	0.70	0.61	-0.08
Ce	0.54	0.13	-0.41
Pr	0.75	3.90	3.18
Nd	0.68	0.75	0.08
Sm	1.04	1.20	0.16
Eu	4.59	7.34	2.88
Gd	1.59	-0.19	-1.81
Tb	1.46	2.68	1.23

<b>Dy</b>	1.12	1.20	0.08
<b>Ho</b>	1.10	3.53	2.46
<b>Er</b>	1.69	1.94	0.26
<b>Tm</b>	3.14	6.29	3.25
<b>Yb</b>	1.28	1.92	0.65
<b>Lu</b>	5.79	9.09	3.51
<b>Hf</b>	2.08	-2.08	-4.26
<b>Ta</b>	53.33	46.67	-14.29
<b>W</b>	-2.11	-2.50	-0.38
<b>Re</b>	25.00	25.00	0.00
<b>Ir</b>	71.43	<100.00	<100.00
<b>Pt</b>	0.00	0.00	0.00
<b>Tl</b>	2.42	3.03	0.62
<b><sup>208</sup>Pb</b>	2.45	5.04	2.65
<b>*Pb</b>	-0.40	0.20	0.60
<b>Bi</b>	2.60	1.04	-1.60
<b>Th</b>	-2.25	0.15	2.34

\*these Pb results were calculated using the data reported from laboratories that summed total Pb based on their isotopic composition measurement.

## Conclusion and consensus values

As stated above, the median and robust standard deviation are the most appropriate determination of the consensus value for each element for CUP-2. These are repeated below in Table 6 for clarification. A dagger next to an element indicates that the uncertainty on the measurement is greater than the measurement itself indicating that it would be theoretically possible for the measurement to be negative. As this is not reasonable, no consensus values are reported for these elements.

**Table 6.** Consensus values for each element analyzed in CUP-2 as part of this compilation. Coverage factor of the uncertainty is two.

Element	Consensus Value ( $\bar{\mu}$ )	Consensus uncertainty ( $\hat{\sigma}$ )
<b>Li</b>	1.30	0.20
<b>Be</b>	0.36	0.09
<b>B</b>	73.14	24.77
<b>Na</b>	6050.01	872.15
<b>Mg</b>	3205.49	498.48
<b>Al</b>	3354.90	390.54
<b>Si</b>	2502.92	798.51
<b>P</b>	375.12	109.79
<b>S</b>	10734.94	1780.12
<b>K</b>	1484.42	240.31
<b>Ca</b>	8342.90	1572.64
<b>Sc</b>	6.65	0.72
<b>Ti</b>	224.93	20.43
<b>V</b>	890.46	80.60
<b>Mn</b>	134.26	17.40
<b>Cr</b>	19.84	2.44
<b>Fe</b>	4408.62	597.36
<b>Co</b>	3.06	0.41
<b>Ni</b>	34.46	4.74
<b>Cu</b>	31.58	5.69
<b>Zn</b>	45.02	14.93
<b>Ga</b>	0.50	0.07
<b>Ge</b>	0.78	0.72
<b>As</b>	450.68	61.56
<b>Se</b>	0.98	0.40
<b>Rb</b>	10.17	1.50
<b>Sr</b>	70.32	7.08
<b>Y</b>	99.01	7.05
<b>Zr</b>	560.20	60.60
<b>Nb</b>	0.70	0.31
<b>Mo</b>	1041.57	84.42
<b>Ru</b>	0.01	0.01
<b>Rh<sup>†</sup></b>		
<b>Pd<sup>†</sup></b>		
<b>Ag<sup>†</sup></b>		
<b>Cd<sup>†</sup></b>		
<b>In</b>	0.04	0.01
<b>Sn</b>	4.72	0.51
<b>Sb</b>	0.18	0.07
<b>Te<sup>†</sup></b>		
<b>Cs</b>	1.29	0.13
<b>Ba</b>	146.73	11.04
<b>La</b>	24.26	7.08
<b>Ce</b>	53.36	4.61

<b>Pr</b>	6.40	0.56
<b>Nd</b>	26.31	2.20
<b>Sm</b>	12.40	0.97
<b>Eu</b>	1.01	0.08
<b>Gd</b>	20.76	3.64
<b>Tb</b>	4.00	0.30
<b>Dy</b>	24.77	1.95
<b>Ho</b>	4.37	0.48
<b>Er</b>	11.61	0.91
<b>Tm</b>	1.49	0.13
<b>Yb</b>	9.21	0.96
<b>Lu</b>	1.10	0.09
<b>Hf</b>	0.49	0.07
<b>Ta</b>	0.08	0.02
<b>W</b>	18.44	2.86
<b>Re</b>	0.03	0.01
<b>Ir<sup>†</sup></b>		
<b>Pt</b>	0.01	<0.01
<b>Tl</b>	4.80	0.81
<b><sup>208</sup>Pb</b>	108.19	14.67
<b>*Pb</b>	356.59	35.25
<b>Bi</b>	1.90	0.23
<b>Th</b>	2169.98	243.47

\*these Pb results were calculated using the data reported from laboratories that summed total Pb based on their isotopic composition measurement.

<sup>†</sup>A dagger next to an element indicates that the uncertainty on the measurement is greater than the measurement itself. Consequently no consensus value is reported.

## Acknowledgements

The data compilation, data analysis, and report authorship was made possible with funding from the U.S. Department of Energy / National Nuclear Security Administration's Office of Nuclear Noncompliance Verification and Office of Nuclear Security Detection and Deterrence. Participation in the interlaboratory comparison exercise by the Canadian Nuclear Laboratories was made possible by funding from the Atomic Energy of Canada Limited, under the auspices of the Federal Nuclear Science and Technology Program. The Canadian Institutions and authors were supported by the Canadian Safety and Security Program, a federal program led by Defence Research and Development Canada's Centre for Security Science, in partnership with Public Safety Canada. For the work conducted at the Canadian Nuclear Laboratories, funding was provided by Atomic Energy of Canada Limited, under the auspices of the Federal Nuclear Science and Technology Program. Roxanne Collins and Carrie Broome from Canadian Nuclear Laboratories are acknowledged for their contribution to the analysis.

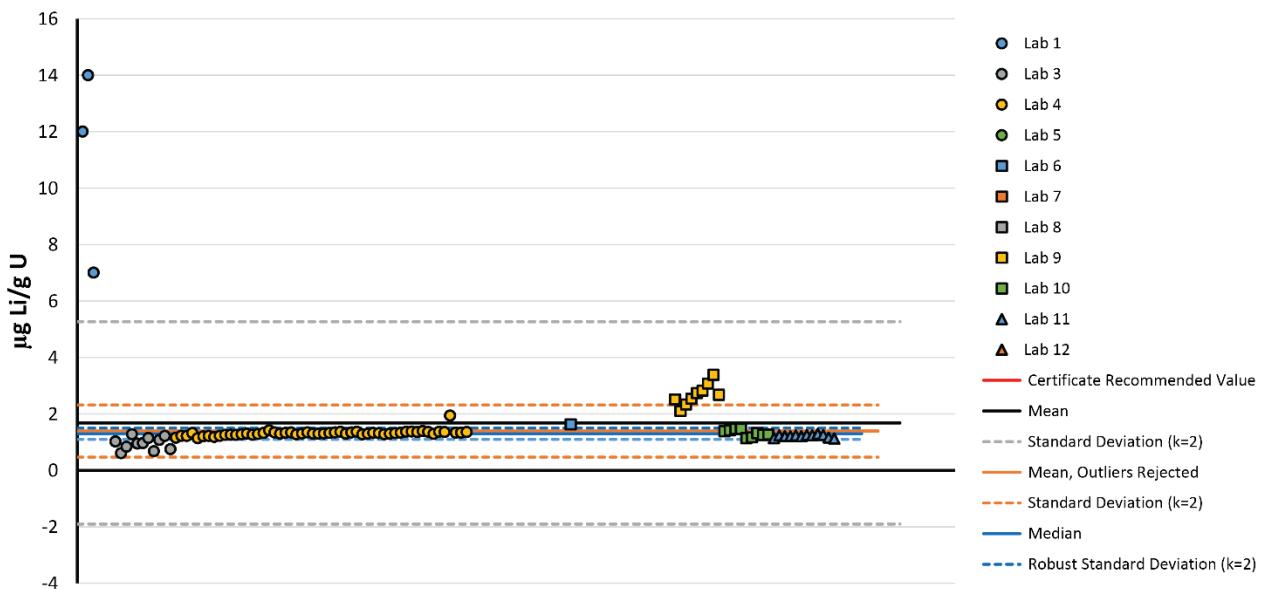
## References

- Analytical Method Committee Technical Brief, 2001. Royal Society of Chemistry.
- CUP-2 Certificate of Analysis, CANMET, Ottawa, Canada.
- Dalton, J.L., Bowman, W.S., 1988. CUP-2: A certified uranium ore concentrate. CANMET.
- Eppich, G., Kips, R., Lindvall, R., 2016. Compilation of LLNL CUP-2 Data. Lawrence Livermore National Laboratory, LLNL-TR-701561.
- Varga, Z., Wallenius, M., Mayer, K., 2010a. Origin assessment of uranium ore concentrates based on their rare-earth elemental impurity pattern. *Radiochim. Acta*, 98, 771-778.
- Varga, Z., Katona, R., Stefánka, Z., Wallenius, M., Mayer, K., Nicholl, A., 2010. Determination of rare-earth elements in uranium-bearing materials by inductively coupled plasma mass spectrometry. *Talanta*, 80, 1744-1749.

## **Appendices**

**Table A1** All data reported for CUP-2 Li concentration. Data precision as laboratory reported.

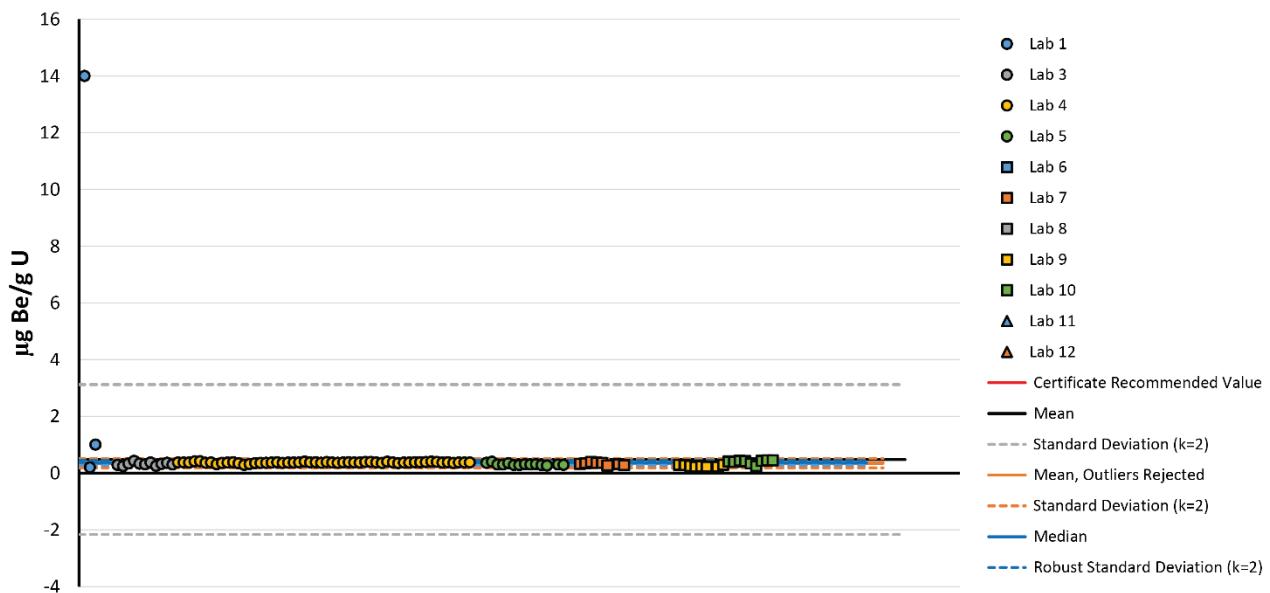
Lab #	Sample #	[Li] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Li] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Li] ( $\mu\text{g/gU}$ )
1	1	12	4	34	1.365	7	7	
1	2	14	4	35	1.273	7	8	
1	3	7	4	36	1.299	7	9	
3	1	1.0	4	37	1.329	8	1	
3	2	0.6	4	38	1.318	8	2	
3	3	0.8	4	39	1.281	8	3	
3	4	1.3	4	40	1.297	8	4	
3	5	1.0	4	41	1.316	8	5	
3	6	1.0	4	42	1.337	8	6	
3	7	1.1	4	43	1.367	8	7	
3	8	0.7	4	44	1.375	8	8	
3	9	1.1	4	45	1.353	8	9	
3	10	1.2	4	46	1.394	9	1	2.515
3	11	0.8	4	47	1.358	9	2	2.100
4	1	1.156	4	48	1.296	9	3	2.334
4	2	1.226	4	49	1.365	9	4	2.530
4	3	1.222	4	50	1.353	9	5	2.731
4	4	1.324	4	51	1.940	9	6	2.822
4	5	1.140	4	52	1.335	9	7	3.072
4	6	1.208	4	53	1.336	9	8	3.380
4	7	1.222	4	54	1.356	9	9	2.673
4	8	1.185	5	1		10	1	1.39
4	9	1.226	5	2		10	2	1.42
4	10	1.256	5	3		10	3	1.47
4	11	1.260	5	4		10	4	1.47
4	12	1.259	5	5		10	5	1.14
4	13	1.282	5	6		10	6	1.16
4	14	1.302	5	7		10	7	1.32
4	15	1.259	5	8		10	8	1.25
4	16	1.286	5	9		10	9	1.27
4	17	1.323	5	10		11	1	1.14
4	18	1.414	5	11		11	2	1.24
4	19	1.339	5	12		11	3	1.21
4	20	1.297	5	13		11	4	1.21
4	21	1.332	5	14		11	5	1.24
4	22	1.339	5	15		11	6	1.21
4	23	1.274	5	16		11	7	1.26
4	24	1.308	5	17		11	8	1.24
4	25	1.347	5	18		11	9	1.29
4	26	1.296	6	1		11	10	1.25
4	27	1.302	6	2	1.623750	11	11	1.17
4	28	1.304	7	1		11	12	1.13
4	29	1.326	7	2		12	1	
4	30	1.340	7	3		12	2	
4	31	1.366	7	4		12	3	
4	32	1.299	7	5		12	4	
4	33	1.342	7	6				



**Figure A1.** All Li concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A2** All data reported for CUP-2 Be concentration. Data precision as laboratory reported.

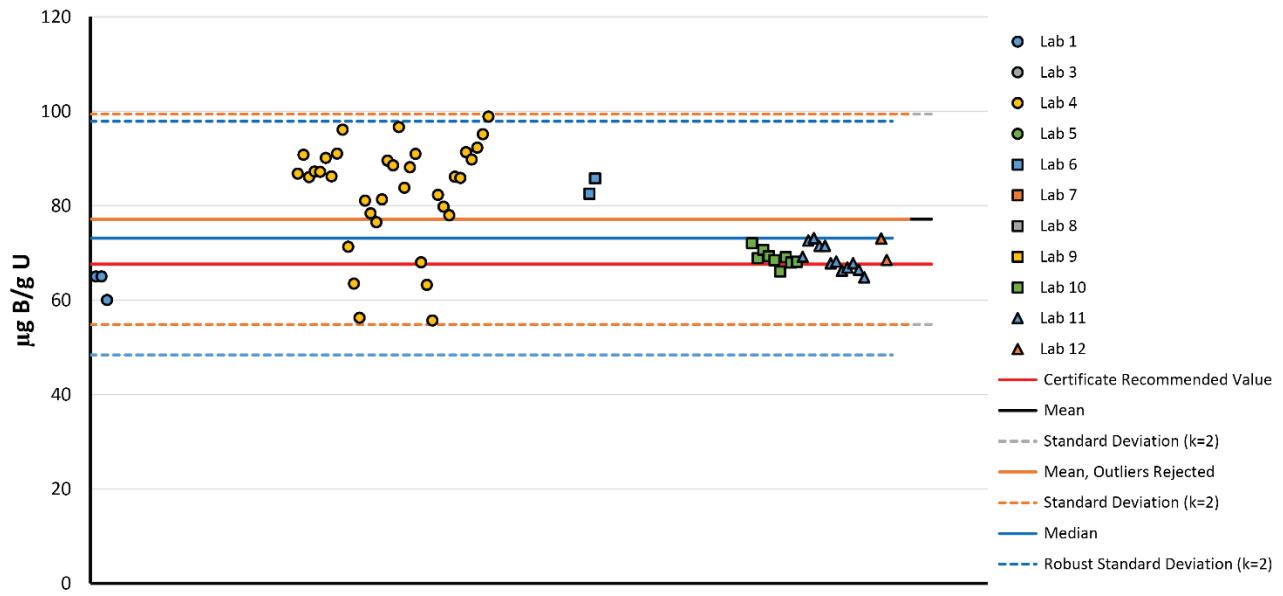
Lab #	Sample #	[Be] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Be] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Be] ( $\mu\text{g/gU}$ )
1	1	14	4	34	0.368	7	8	0.3121
1	2	0.2	4	35	0.394	7	9	0.2728
1	3	1	4	36	0.389	8	1	
3	1	0.3	4	37	0.374	8	2	
3	2	0.2	4	38	0.353	8	3	
3	3	0.3	4	39	0.398	8	4	
3	4	0.4	4	40	0.375	8	5	
3	5	0.3	4	41	0.351	8	6	
3	6	0.3	4	42	0.366	8	7	
3	7	0.4	4	43	0.365	8	8	
3	8	0.3	4	44	0.378	8	9	
3	9	0.4	4	45	0.380	9	1	0.286
3	10	0.4	4	46	0.388	9	2	0.283
3	11	0.3	4	47	0.406	9	3	0.250
4	1	0.371	4	48	0.395	9	4	0.223
4	2	0.376	4	49	0.368	9	5	0.240
4	3	0.370	4	50	0.380	9	6	0.223
4	4	0.413	4	51	0.356	9	7	
4	5	0.414	4	52	0.376	9	8	0.218
4	6	0.360	4	53	0.375	9	9	0.289
4	7	0.374	4	54	0.373	10	1	0.40
4	8	0.313	5	1		10	2	0.39
4	9	0.355	5	2		10	3	0.43
4	10	0.365	5	3	0.36	10	4	0.42
4	11	0.380	5	4	0.40	10	5	0.34
4	12	0.340	5	5	0.30	10	6	0.25
4	13	0.285	5	6	0.30	10	7	0.43
4	14	0.317	5	7	0.35	10	8	0.44
4	15	0.348	5	8	0.28	10	9	0.44
4	16	0.354	5	9	0.28	11	1	
4	17	0.359	5	10	0.31	11	2	
4	18	0.367	5	11	0.30	11	3	
4	19	0.379	5	12	0.31	11	4	
4	20	0.354	5	13	0.28	11	5	
4	21	0.367	5	14	0.26	11	6	
4	22	0.368	5	15		11	7	
4	23	0.372	5	16	0.30	11	8	
4	24	0.403	5	17	0.29	11	9	
4	25	0.376	6	1		11	10	
4	26	0.378	6	2		11	11	
4	27	0.359	7	1	0.3255	11	12	
4	28	0.387	7	2	0.3430	12	1	
4	29	0.367	7	3	0.3908	12	2	
4	30	0.361	7	4	0.3592	12	3	
4	31	0.376	7	5	0.3565	12	4	
4	32	0.379	7	6	0.2625			
4	33	0.372	7	7				



**Figure A2.** All Be concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A3** All data reported for CUP-2 B concentration. Data precision as laboratory reported.

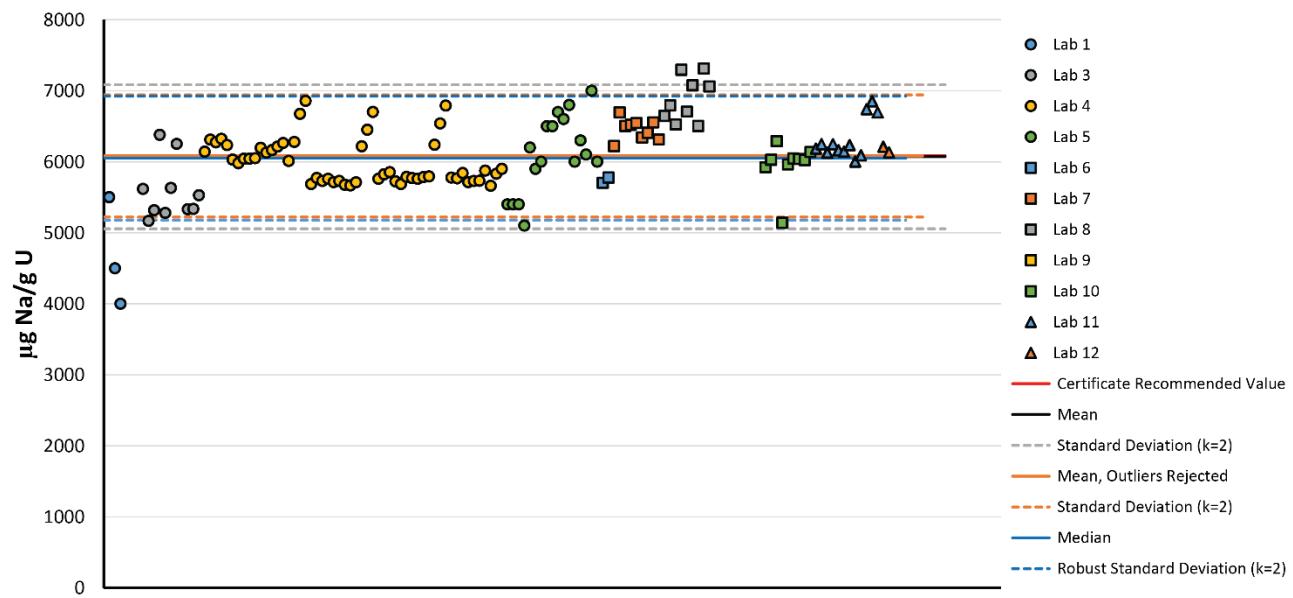
Lab #	Sample #	[B] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[B] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[B] ( $\mu\text{g/gU}$ )
1	1	65	4	34	76.505	7	8	
1	2	65	4	35	81.316	7	9	
1	3	60	4	36	89.549	8	1	
3	1		4	37	88.545	8	2	
3	2		4	38	96.644	8	3	
3	3		4	39	83.790	8	4	
3	4		4	40	88.141	8	5	
3	5		4	41	90.977	8	6	
3	6		4	42	68.000	8	7	
3	7		4	43	63.244	8	8	
3	8		4	44	55.675	8	9	
3	9		4	45	82.279	9	1	
3	10		4	46	79.794	9	2	
3	11		4	47	77.972	9	3	
4	1		4	48	86.130	9	4	
4	2		4	49	85.863	9	5	
4	3		4	50	91.346	9	6	
4	4		4	51	89.802	9	7	
4	5		4	52	92.287	9	8	
4	6		4	53	95.144	9	9	
4	7		4	54	98.891	10	1	72.05
4	8		5	1		10	2	68.89
4	9		5	2		10	3	70.60
4	10		5	3		10	4	69.30
4	11		5	4		10	5	68.43
4	12		5	5		10	6	66.03
4	13		5	6		10	7	69.09
4	14		5	7		10	8	67.94
4	15		5	8		10	9	68.12
4	16		5	9		11	1	69.18
4	17		5	10		11	2	72.64
4	18		5	11		11	3	73.14
4	19		5	12		11	4	71.45
4	20	86.778	5	13		11	5	71.49
4	21	90.800	5	14		11	6	67.77
4	22	86.053	5	15		11	7	68.19
4	23	87.254	5	16		11	8	66.25
4	24	87.180	5	17		11	9	66.91
4	25	90.109	6	1	82.49652	11	10	67.80
4	26	86.185	6	2	85.75792	11	11	66.43
4	27	91.045	7	1		11	12	64.80
4	28	96.110	7	2		12	1	
4	29	71.287	7	3		12	2	
4	30	63.493	7	4		12	3	73.0
4	31	56.245	7	5		12	4	68.5
4	32	81.059	7	6				
4	33	78.387	7	7				



**Figure A3.** All B concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A4** All data reported for CUP-2 Na concentration. Data precision as laboratory reported.

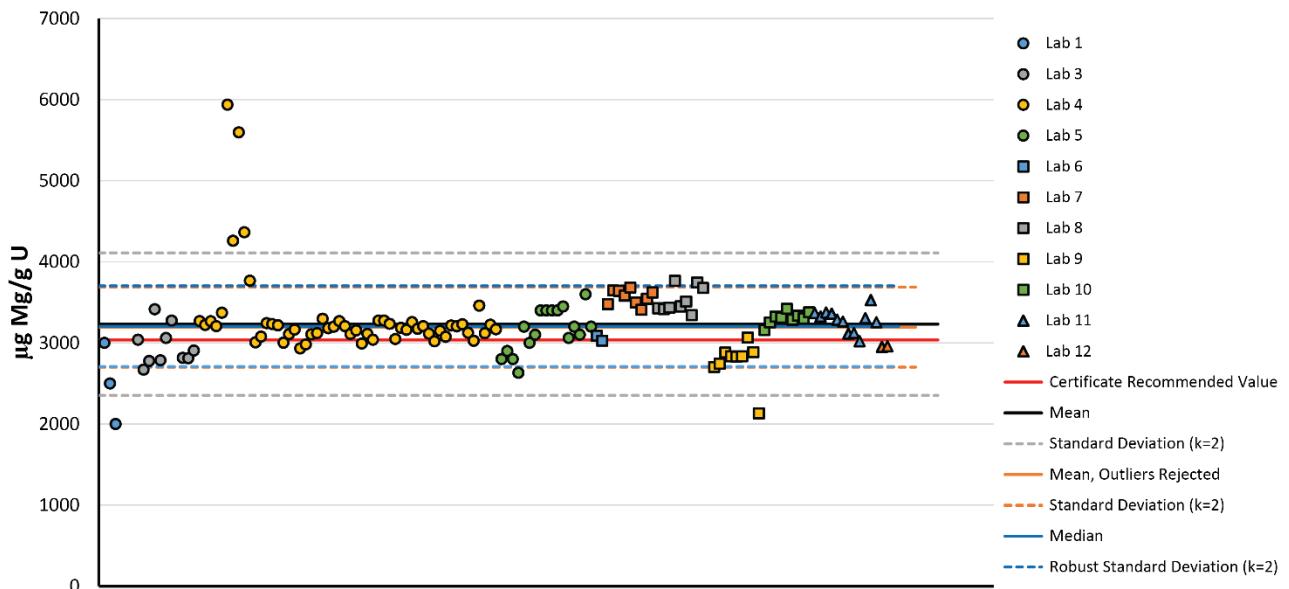
Lab #	Sample #	[Na] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Na] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Na] ( $\mu\text{g/gU}$ )
1	1	5500	4	34	5852.541	7	8	6553.0037
1	2	4500	4	35	5724.320	7	9	6313.1543
1	3	4000	4	36	5684.431	8	1	6640
3	1	5617.1	4	37	5786.039	8	2	6790
3	2	5165.1	4	38	5769.202	8	3	6530
3	3	5317.1	4	39	5757.941	8	4	7290
3	4	6380.0	4	40	5784.192	8	5	6700
3	5	5279.4	4	41	5794.056	8	6	7080
3	6	5632.3	4	42	6239.239	8	7	6500
3	7	6250.5	4	43	6539.053	8	8	7310
3	8		4	44	6788.855	8	9	7080
3	9	5331.4	4	45	5775.171	9	1	
3	10	5336.5	4	46	5765.704	9	2	
3	11	5529.0	4	47	5840.060	9	3	
4	1	6140.534	4	48	5712.957	9	4	
4	2	6309.646	4	49	5730.675	9	5	
4	3	6273.804	4	50	5732.863	9	6	
4	4	6321.607	4	51	5873.808	9	7	
4	5	6233.688	4	52	5661.470	9	8	
4	6	6028.567	4	53	5831.436	9	9	
4	7	5978.222	4	54	5899.560	10	1	5921.18
4	8	6042.250	5	1	5400	10	2	6028.29
4	9	6041.815	5	2	5400	10	3	6287.72
4	10	6050.015	5	3	5400	10	4	5138.85
4	11	6193.544	5	4	5100	10	5	5960.49
4	12	6127.823	5	5	6200	10	6	6045.70
4	13	6162.359	5	6	5900	10	7	6036.15
4	14	6212.241	5	7	6000	10	8	6023.53
4	15	6263.145	5	8	6500	10	9	6134.56
4	16	6010.706	5	9	6500	11	1	6185.28
4	17	6278.233	5	10	6700	11	2	6248.17
4	18	6675.329	5	11	6600	11	3	6127.16
4	19	6857.333	5	12	6800	11	4	6246.64
4	20	5684.903	5	13	6000	11	5	6163.31
4	21	5770.965	5	14	6300	11	6	6142.67
4	22	5730.530	5	15	6100	11	7	6234.39
4	23	5759.335	5	16	7000	11	8	6003.49
4	24	5711.944	5	17	6000	11	9	6090.10
4	25	5728.930	6	1	5701.390	11	10	6740.42
4	26	5675.588	6	2	5776.315	11	11	6851.85
4	27	5665.837	7	1	6219.2402	11	12	6694.35
4	28	5709.219	7	2	6694.4407	12	1	6210
4	29	6215.766	7	3	6502.6759	12	2	6130
4	30	6449.910	7	4	6519.9599	12	3	
4	31	6700.660	7	5	6543.1996	12	4	
4	32	5759.261	7	6	6338.9334			
4	33	5821.995	7	7	6407.2550			



**Figure A4.** All Na concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A5** All data reported for CUP-2 Mg concentration. Data precision as laboratory reported.

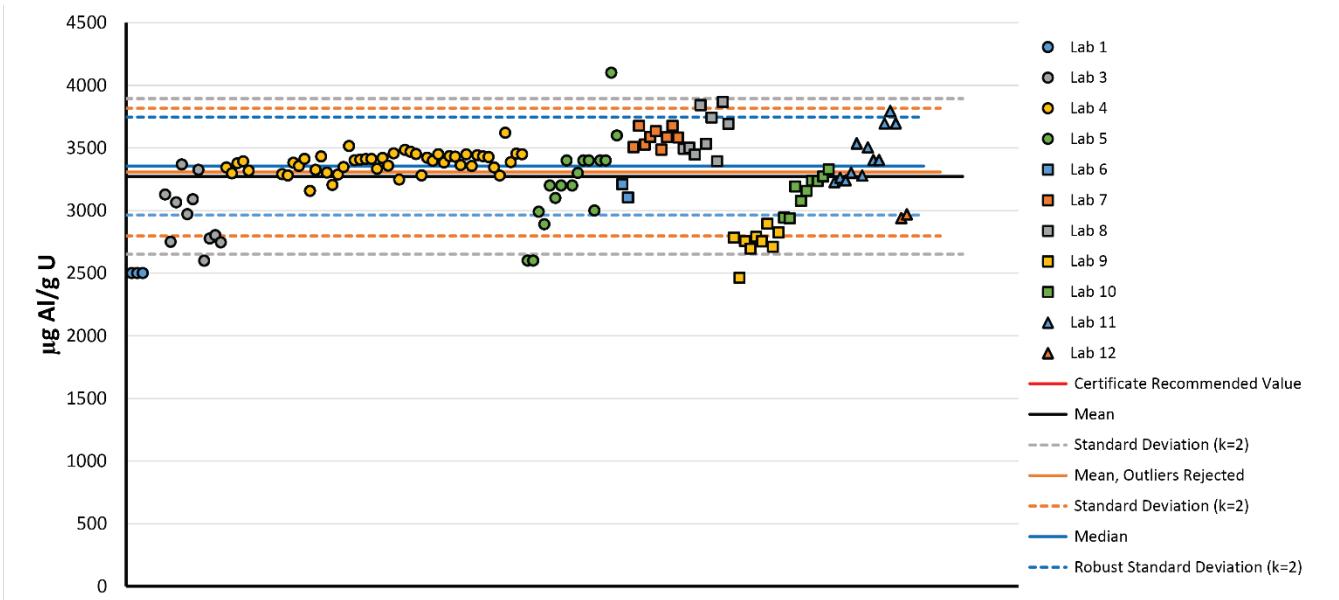
Lab #	Sample #	[Mg] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mg] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mg] ( $\mu\text{g/gU}$ )
1	1	3000	4	34	3275.914	7	8	3543.1403
1	2	2500	4	35	3233.463	7	9	3621.4339
1	3	2000	4	36	3047.593	8	1	3430
3	1	3039.1	4	37	3183.969	8	2	3420
3	2	2669.3	4	38	3161.222	8	3	3430
3	3	2777.3	4	39	3256.051	8	4	3760
3	4	3415.2	4	40	3174.530	8	5	3450
3	5	2785.2	4	41	3206.766	8	6	3510
3	6	3059.3	4	42	3114.139	8	7	3340
3	7	3275.1	4	43	3018.893	8	8	3740
3	8		4	44	3147.358	8	9	3680
3	9	2814.9	4	45	3075.183	9	1	2701.978
3	10	2811.7	4	46	3214.963	9	2	2742.350
3	11	2906.3	4	47	3203.476	9	3	2880.613
4	1	3268.723	4	48	3230.868	9	4	2833.743
4	2	3221.109	4	49	3125.640	9	5	2830.462
4	3	3267.338	4	50	3026.457	9	6	2834.768
4	4	3205.494	4	51	3459.878	9	7	3065.273
4	5	3371.027	4	52	3117.326	9	8	2883.276
4	6	5937.413	4	53	3224.315	9	9	2130.522
4	7	4258.560	4	54	3167.792	10	1	3158.91
4	8	5597.598	5	1	2800	10	2	3251.80
4	9	4364.891	5	2	2900	10	3	3323.24
4	10	3765.943	5	3	2800	10	4	3308.52
4	11	3005.692	5	4	2630	10	5	3417.79
4	12	3077.042	5	5	3200	10	6	3285.68
4	13	3243.686	5	6	3000	10	7	3336.00
4	14	3231.165	5	7	3100	10	8	3301.68
4	15	3218.031	5	8	3400	10	9	3375.84
4	16	3001.742	5	9	3400	11	1	3369.96
4	17	3107.921	5	10	3400	11	2	3325.33
4	18	3163.773	5	11	3400	11	3	3376.79
4	19	2931.654	5	12	3450	11	4	3359.23
4	20	2980.111	5	13	3060	11	5	3286.02
4	21	3104.760	5	14	3200	11	6	3264.79
4	22	3120.236	5	15	3100	11	7	3114.81
4	23	3296.809	5	16	3600	11	8	3123.49
4	24	3179.906	5	17	3200	11	9	3022.16
4	25	3200.460	6	1	3087.194	11	10	3304.79
4	26	3267.509	6	2	3026.579	11	11	3525.94
4	27	3205.936	7	1	3475.8794	11	12	3253.27
4	28	3108.947	7	2	3645.5593	12	1	2950
4	29	3153.861	7	3	3640.5570	12	2	2960
4	30	2992.321	7	4	3581.6597	12	3	
4	31	3111.265	7	5	3680.5881	12	4	
4	32	3039.535	7	6	3498.7416			
4	33	3275.054	7	7	3408.0448			



**Figure A5.** All Mg concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A6** All data reported for CUP-2 Al concentration. Data precision as laboratory reported.

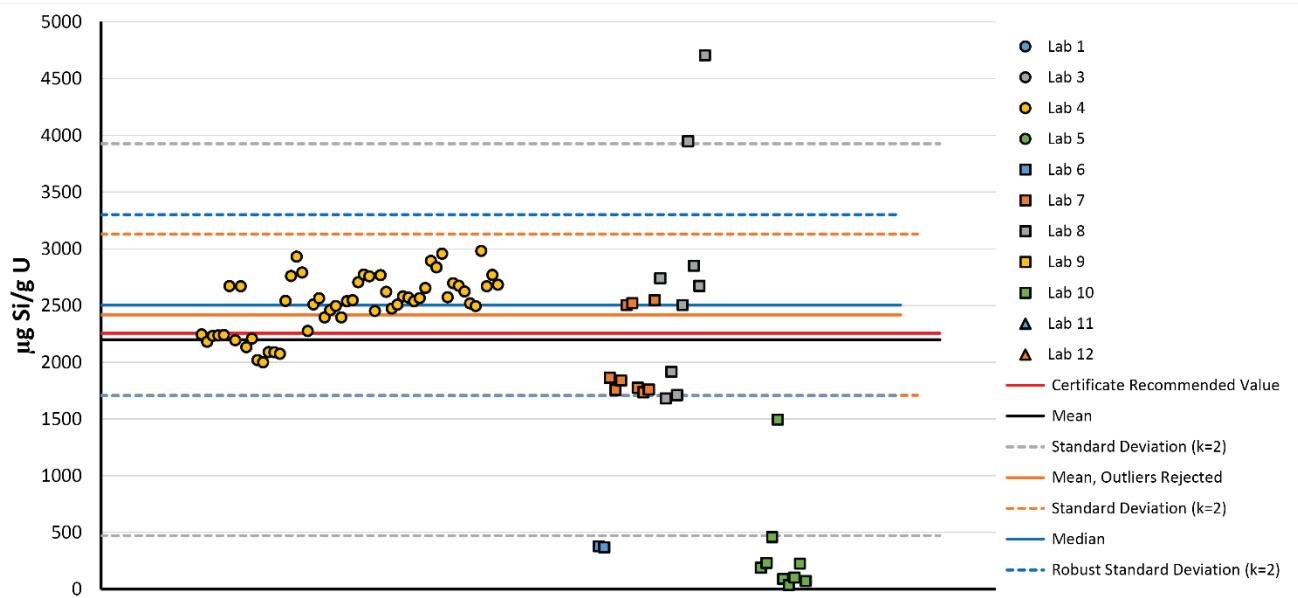
Lab #	Sample #	[Al] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Al] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Al] ( $\mu\text{g/gU}$ )
1	1	2500	4	34	3469.586	7	8	3675.6285
1	2	2500	4	35	3450.704	7	9	3583.4302
1	3	2500	4	36	3280.437	8	1	3490
3	1	3128.5	4	37	3422.271	8	2	3500
3	2	2750.9	4	38	3397.277	8	3	3450
3	3	3065.6	4	39	3449.978	8	4	3840
3	4	3367.6	4	40	3382.992	8	5	3530
3	5	2971.5	4	41	3434.994	8	6	3740
3	6	3090.7	4	42	3429.803	8	7	3390
3	7	3324.2	4	43	3363.021	8	8	3870
3	8	2599.8	4	44	3449.017	8	9	3690
3	9	2777.0	4	45	3355.477	9	1	2784.356
3	10	2802.7	4	46	3442.042	9	2	2463.557
3	11	2746.0	4	47	3432.775	9	3	2756.628
4	1	3343.869	4	48	3427.078	9	4	2694.307
4	2	3296.447	4	49	3344.155	9	5	2790.601
4	3	3377.765	4	50	3279.268	9	6	2754.005
4	4	3392.655	4	51	3620.553	9	7	2894.494
4	5	3317.583	4	52	3385.738	9	8	2709.793
4	6		4	53	3453.647	9	9	2825.634
4	7		4	54	3450.010	10	1	2942.84
4	8		5	1	2600	10	2	2938.24
4	9		5	2	2600	10	3	3192.32
4	10		5	3	2990	10	4	3076.57
4	11	3290.017	5	4	2890	10	5	3156.73
4	12	3279.797	5	5	3200	10	6	3237.49
4	13	3381.606	5	6	3100	10	7	3235.01
4	14	3354.902	5	7	3200	10	8	3272.22
4	15	3412.956	5	8	3400	10	9	3329.02
4	16	3156.600	5	9	3200	11	1	3228.07
4	17	3324.520	5	10	3300	11	2	3263.09
4	18	3432.249	5	11	3400	11	3	3242.01
4	19	3302.142	5	12	3400	11	4	3301.25
4	20	3204.255	5	13	3000	11	5	3535.38
4	21	3287.182	5	14	3400	11	6	3279.04
4	22	3347.381	5	15	3400	11	7	3505.44
4	23	3514.604	5	16	4100	11	8	3404.61
4	24	3401.757	5	17	3600	11	9	3402.14
4	25	3406.416	6	1	3209.467	11	10	3694.89
4	26	3410.771	6	2	3104.536	11	11	3794.81
4	27	3412.286	7	1	3506.2614	11	12	3696.81
4	28	3332.545	7	2	3675.9204	12	1	2940
4	29	3419.310	7	3	3525.5404	12	2	2970
4	30	3358.222	7	4	3586.7131	12	3	
4	31	3456.249	7	5	3633.0256	12	4	
4	32	3247.642	7	6	3485.1555			
4	33	3485.008	7	7	3585.7797			



**Figure A6.** All Al concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A7** All data reported for CUP-2 Si concentration. Data precision as laboratory reported.

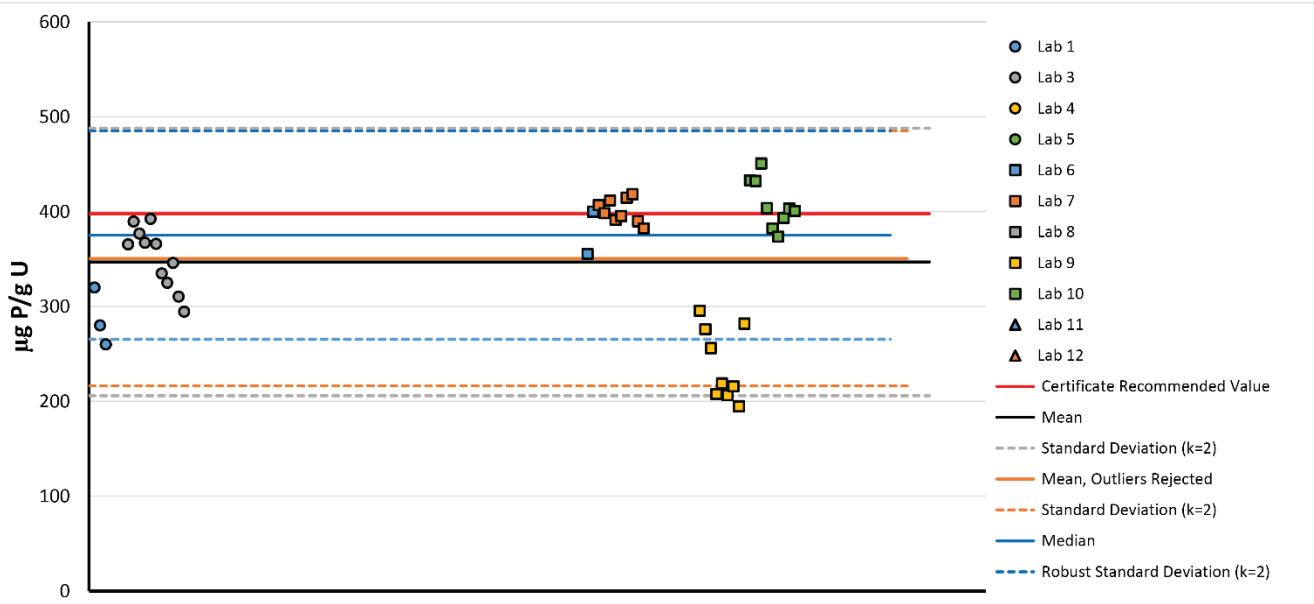
Lab #	Sample #	[Si] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Si] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Si] ( $\mu\text{g/gU}$ )
1	1		4	34	2620.158	7	8	1759.3402
1	2		4	35	2472.306	7	9	2546.6429
1	3		4	36	2506.795	8	1	2740
3	1		4	37	2580.799	8	2	1680
3	2		4	38	2569.267	8	3	1920
3	3		4	39	2536.837	8	4	1710
3	4		4	40	2565.117	8	5	2500
3	5		4	41	2654.185	8	6	3950
3	6		4	42	2892.929	8	7	2850
3	7		4	43	2836.113	8	8	2670
3	8		4	44	2955.889	8	9	4710
3	9		4	45	2572.762	9	1	
3	10		4	46	2696.519	9	2	
3	11		4	47	2673.972	9	3	
4	1	2243.748	4	48	2623.695	9	4	
4	2	2179.369	4	49	2518.257	9	5	
4	3	2231.860	4	50	2494.681	9	6	
4	4	2236.038	4	51	2980.979	9	7	
4	5	2239.870	4	52	2668.729	9	8	
4	6	2670.846	4	53	2768.376	9	9	
4	7	2193.666	4	54	2682.611	10	1	188.76
4	8	2668.547	5	1		10	2	230.77
4	9	2132.550	5	2		10	3	457.56
4	10	2206.995	5	3		10	4	1493.87
4	11	2018.640	5	4		10	5	90.36
4	12	1998.840	5	5		10	6	36.75
4	13	2088.478	5	6		10	7	102.08
4	14	2088.342	5	7		10	8	225.09
4	15	2073.759	5	8		10	9	72.01
4	16	2540.009	5	9		11	1	
4	17	2760.274	5	10		11	2	
4	18	2929.824	5	11		11	3	
4	19	2790.132	5	12		11	4	
4	20	2275.359	5	13		11	5	
4	21	2509.935	5	14		11	6	
4	22	2563.623	5	15		11	7	
4	23	2394.091	5	16		11	8	
4	24	2458.757	5	17		11	9	
4	25	2495.959	6	1	378.2335	11	10	
4	26	2395.276	6	2	369.3248	11	11	
4	27	2537.343	7	1	1863.6549	11	12	
4	28	2546.373	7	2	1755.3475	12	1	
4	29	2704.139	7	3	1839.7847	12	2	
4	30	2772.632	7	4	2502.9191	12	3	
4	31	2756.080	7	5	2519.7144	12	4	
4	32	2451.977	7	6	1775.2945			
4	33	2767.056	7	7	1735.0377			



**Figure A7.** All Si concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A8** All data reported for CUP-2 P concentration. Data precision as laboratory reported.

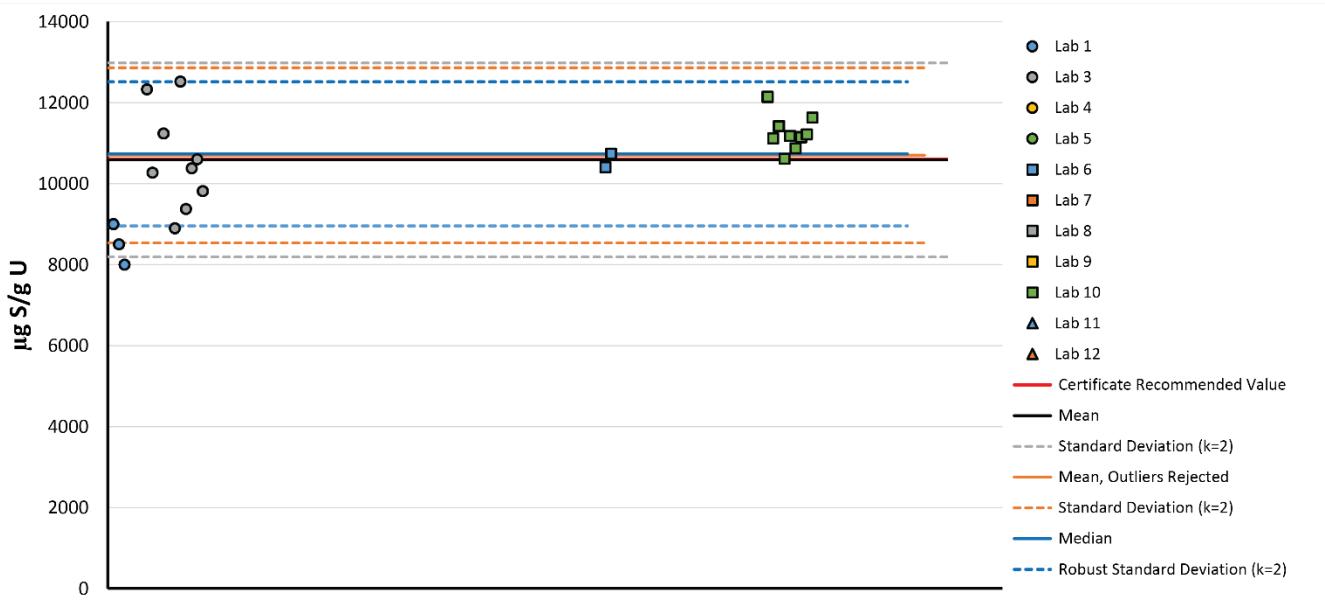
Lab #	Sample #	[P] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[P] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[P] ( $\mu\text{g/gU}$ )
1	1	320	4	34		7	8	389.7649
1	2	280	4	35		7	9	382.2462
1	3	260	4	36		8	1	
3	1	365.3	4	37		8	2	
3	2	389.4	4	38		8	3	
3	3	376.7	4	39		8	4	
3	4	367.0	4	40		8	5	
3	5	392.3	4	41		8	6	
3	6	366.0	4	42		8	7	
3	7	334.8	4	43		8	8	
3	8	324.8	4	44		8	9	
3	9	345.9	4	45		9	1	295.494
3	10	310.4	4	46		9	2	275.937
3	11	294.6	4	47		9	3	256.010
4	1		4	48		9	4	207.610
4	2		4	49		9	5	218.833
4	3		4	50		9	6	206.335
4	4		4	51		9	7	215.800
4	5		4	52		9	8	194.648
4	6		4	53		9	9	281.778
4	7		4	54		10	1	432.71
4	8		5	1		10	2	432.23
4	9		5	2		10	3	450.76
4	10		5	3		10	4	403.56
4	11		5	4		10	5	382.16
4	12		5	5		10	6	373.49
4	13		5	6		10	7	393.29
4	14		5	7		10	8	403.18
4	15		5	8		10	9	400.57
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1	355.3467	11	10	
4	26		6	2	399.8886	11	11	
4	27		7	1	406.8192	11	12	
4	28		7	2	398.2957	12	1	
4	29		7	3	411.7143	12	2	
4	30		7	4	391.1340	12	3	
4	31		7	5	395.2592	12	4	
4	32		7	6	414.6454			
4	33		7	7	418.3398			



**Figure A8.** All P concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A9** All data reported for CUP-2 S concentration. Data precision as laboratory reported.

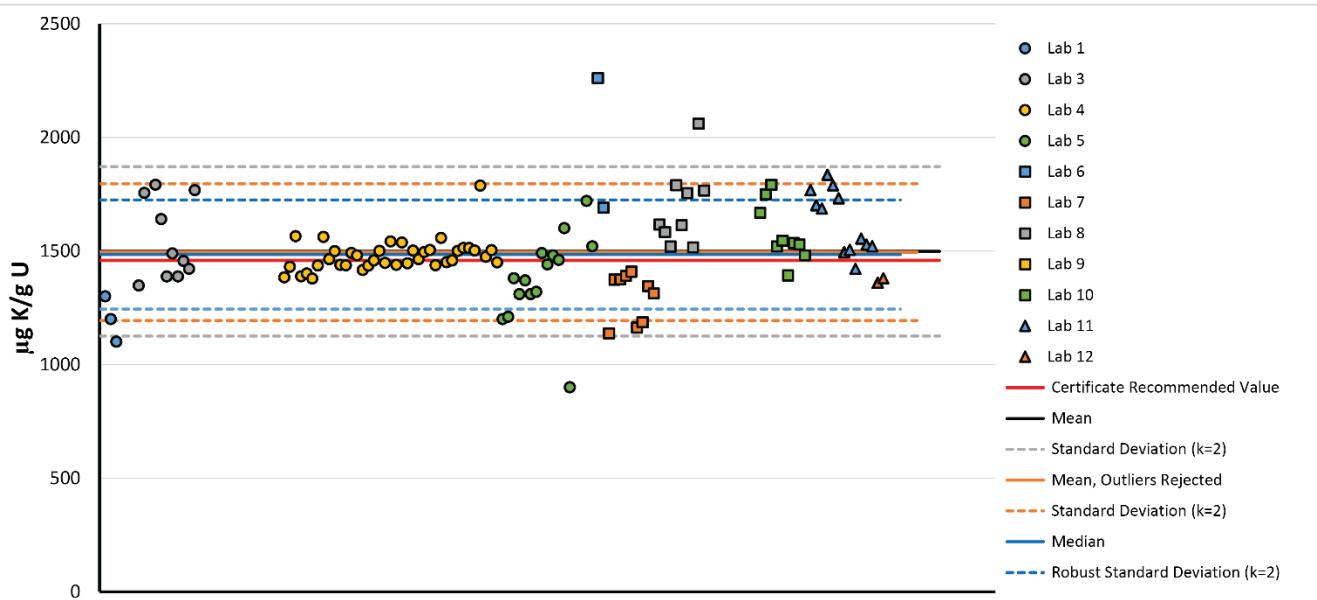
Lab #	Sample #	[S] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[S] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[S] ( $\mu\text{g/gU}$ )
1	1	9000	4	34		7	8	
1	2	8500	4	35		7	9	
1	3	8000	4	36		8	1	
3	1	12327.9	4	37		8	2	
3	2	10270.2	4	38		8	3	
3	3		4	39		8	4	
3	4	11237.8	4	40		8	5	
3	5		4	41		8	6	
3	6	8897.2	4	42		8	7	
3	7	12524.4	4	43		8	8	
3	8	9373.1	4	44		8	9	
3	9	10377.1	4	45		9	1	
3	10	10602.8	4	46		9	2	
3	11	9815.2	4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	12145.71
4	8		5	1		10	2	11118.74
4	9		5	2		10	3	11418.82
4	10		5	3		10	4	10612.91
4	11		5	4		10	5	11179.00
4	12		5	5		10	6	10872.80
4	13		5	6		10	7	11149.82
4	14		5	7		10	8	11214.43
4	15		5	8		10	9	11629.41
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1	10406.23	11	10	
4	26		6	2	10734.94	11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A9.** All S concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A10** All data reported for CUP-2 K concentration. Data precision as laboratory reported.

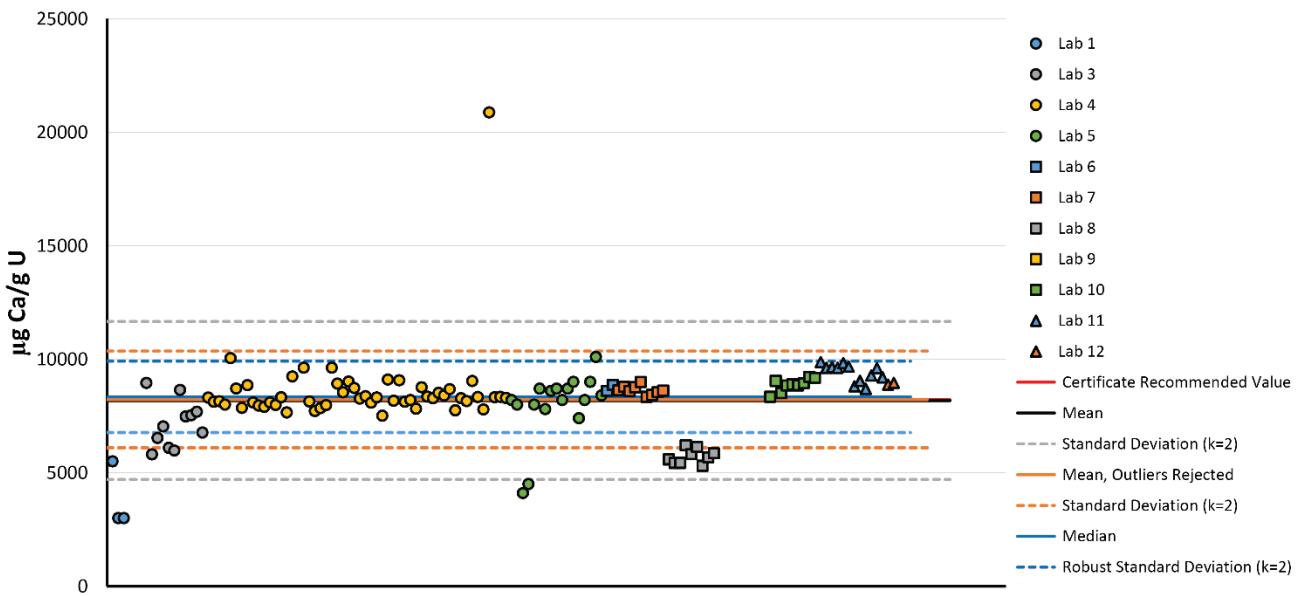
Lab #	Sample #	[K] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[K] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[K] ( $\mu\text{g/gU}$ )
1	1	1300	4	34	1447.039	7	8	1344.4905
1	2	1200	4	35	1541.969	7	9	1312.6852
1	3	1100	4	36	1438.453	8	1	1620
3	1	1347.1	4	37	1537.075	8	2	1580
3	2	1754.8	4	38	1445.551	8	3	1520
3	3		4	39	1500.730	8	4	1790
3	4	1791.3	4	40	1462.961	8	5	1610
3	5	1639.8	4	41	1494.523	8	6	1750
3	6	1387.6	4	42	1504.018	8	7	1520
3	7	1488.3	4	43	1437.396	8	8	2060
3	8	1387.1	4	44	1557.107	8	9	1770
3	9	1455.3	4	45	1450.408	9	1	
3	10	1421.5	4	46	1457.829	9	2	
3	11	1767.5	4	47	1499.894	9	3	
4	1		4	48	1513.522	9	4	
4	2		4	49	1512.335	9	5	
4	3		4	50	1501.562	9	6	
4	4		4	51	1786.845	9	7	
4	5		4	52	1474.282	9	8	
4	6		4	53	1503.002	9	9	
4	7		4	54	1449.548	10	1	1667.63
4	8		5	1	1200	10	2	1749.11
4	9		5	2	1210	10	3	1790.42
4	10		5	3	1380	10	4	1519.03
4	11		5	4	1310	10	5	1544.87
4	12		5	5	1370	10	6	1392.07
4	13		5	6	1310	10	7	1534.21
4	14		5	7	1320	10	8	1527.46
4	15		5	8	1490	10	9	1480.32
4	16	1383.465	5	9	1440	11	1	1767.71
4	17	1430.244	5	10	1480	11	2	1701.31
4	18	1564.519	5	11	1460	11	3	1686.44
4	19	1387.920	5	12	1600	11	4	1834.96
4	20	1400.455	5	13	900	11	5	1788.60
4	21	1378.391	5	14		11	6	1731.60
4	22	1435.727	5	15		11	7	1493.11
4	23	1561.564	5	16	1720	11	8	1505.10
4	24	1463.217	5	17	1520	11	9	1421.49
4	25	1498.983	6	1	2260.204	11	10	1554.19
4	26	1438.844	6	2	1689.768	11	11	1528.14
4	27	1436.665	7	1	1137.2006	11	12	1521.12
4	28	1491.242	7	2	1373.1444	12	1	1360
4	29	1480.511	7	3	1374.2527	12	2	1380
4	30	1415.923	7	4	1389.2880	12	3	
4	31	1434.700	7	5	1408.2497	12	4	
4	32	1457.599	7	6	1162.4701			
4	33	1499.898	7	7	1185.4999			



**Figure A10.** All K concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A11** All data reported for CUP-2 Ca concentration. Data precision as laboratory reported.

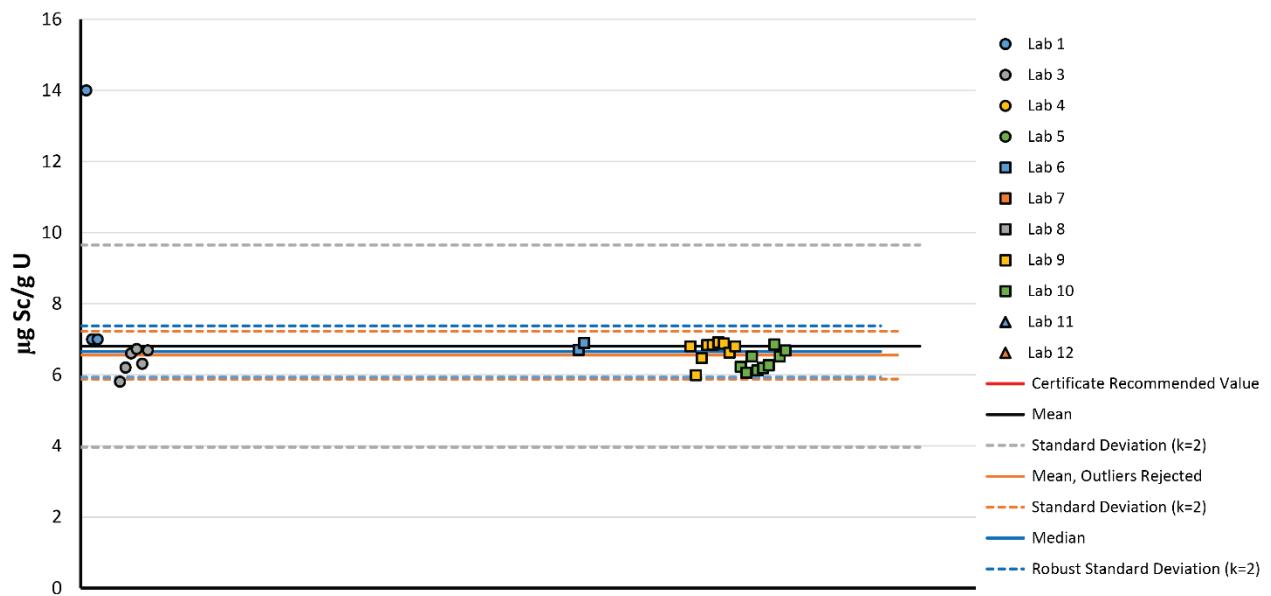
Lab #	Sample #	[Ca] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ca] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ca] ( $\mu\text{g/gU}$ )
1	1	5500	4	34	8170.718	7	8	8548.3700
1	2	3000	4	35	9073.629	7	9	8606.3592
1	3	3000	4	36	8123.367	8	1	5590
3	1	8953.7	4	37	8202.051	8	2	5430
3	2	5806.4	4	38	7813.544	8	3	5430
3	3	6529.2	4	39	8763.600	8	4	6210
3	4	7042.0	4	40	8348.308	8	5	5810
3	5	6091.2	4	41	8280.683	8	6	6140
3	6	5974.3	4	42	8515.815	8	7	5300
3	7	8649.2	4	43	8404.154	8	8	5680
3	8	7475.1	4	44	8680.109	8	9	5850
3	9	7531.6	4	45	7744.614	9	1	
3	10	7686.2	4	46	8277.065	9	2	
3	11	6768.2	4	47	8158.198	9	3	
4	1	8306.016	4	48	9042.781	9	4	
4	2	8121.627	4	49	8332.026	9	5	
4	3	8151.842	4	50	7787.500	9	6	
4	4	7999.601	4	51	20874.464	9	7	
4	5	10045.672	4	52	8321.513	9	8	
4	6	8709.315	4	53	8340.591	9	9	
4	7	7855.732	4	54	8291.221	10	1	8342.90
4	8	8857.804	5	1	8200	10	2	9042.96
4	9	8092.075	5	2	8000	10	3	8510.55
4	10	7954.829	5	3	4100	10	4	8838.62
4	11	7898.237	5	4	4500	10	5	8885.72
4	12	8098.135	5	5	8000	10	6	8845.75
4	13	7983.244	5	6	8700	10	7	8944.34
4	14	8326.609	5	7	7800	10	8	9221.33
4	15	7658.197	5	8	8600	10	9	9182.58
4	16	9244.493	5	9	8700	11	1	9870.38
4	17		5	10	8200	11	2	9621.43
4	18	9626.610	5	11	8700	11	3	9645.29
4	19	8138.307	5	12	9000	11	4	9627.85
4	20	7718.039	5	13	7400	11	5	9824.95
4	21	7850.714	5	14	8200	11	6	9670.37
4	22	7982.650	5	15	9000	11	7	8802.33
4	23	9622.024	5	16	10100	11	8	9043.25
4	24	8928.369	5	17	8400	11	9	8691.87
4	25	8540.688	6	1	8602.801	11	10	9278.41
4	26	9015.179	6	2	8861.971	11	11	9602.04
4	27	8731.879	7	1	8624.4289	11	12	9198.80
4	28	8263.945	7	2	8787.8656	12	1	8880
4	29	8369.652	7	3	8594.9315	12	2	8960
4	30	8085.427	7	4	8766.0288	12	3	
4	31	8321.017	7	5	8995.4147	12	4	
4	32	7508.464	7	6	8343.2982			
4	33	9100.545	7	7	8428.1036			



**Figure A11.** All Ca concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A12** All data reported for CUP-2 Sc concentration. Data precision as laboratory reported.

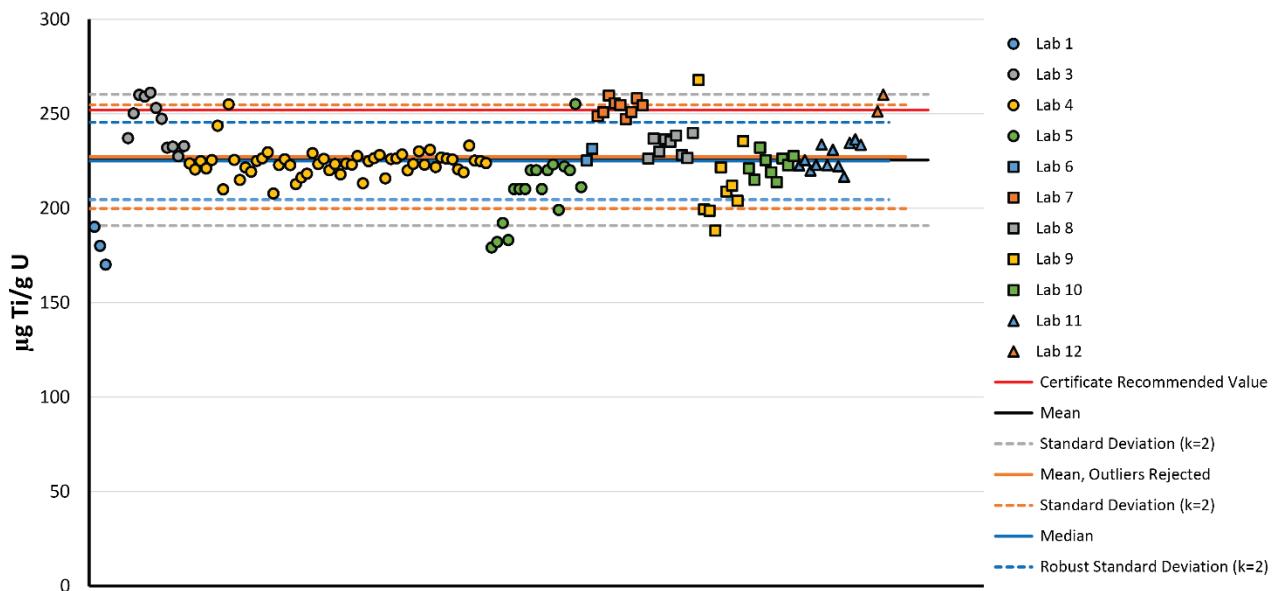
Lab #	Sample #	[Sc] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sc] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sc] ( $\mu\text{g/gU}$ )
1	1	14	4	34		7	8	
1	2	7	4	35		7	9	
1	3	7	4	36		8	1	
3	1	5.8	4	37		8	2	
3	2	6.2	4	38		8	3	
3	3	6.6	4	39		8	4	
3	4	6.7	4	40		8	5	
3	5	6.3	4	41		8	6	
3	6	6.7	4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	6.800
3	10		4	46		9	2	5.989
3	11		4	47		9	3	6.470
4	1		4	48		9	4	6.837
4	2		4	49		9	5	6.843
4	3		4	50		9	6	6.910
4	4		4	51		9	7	6.876
4	5		4	52		9	8	6.622
4	6		4	53		9	9	6.800
4	7		4	54		10	1	6.23
4	8		5	1		10	2	6.06
4	9		5	2		10	3	6.51
4	10		5	3		10	4	6.12
4	11		5	4		10	5	6.19
4	12		5	5		10	6	6.27
4	13		5	6		10	7	6.85
4	14		5	7		10	8	6.52
4	15		5	8		10	9	6.69
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1	6.700044	11	10	
4	26		6	2	6.894286	11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A12.** All Sc concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A13** All data reported for CUP-2 Ti concentration. Data precision as laboratory reported.

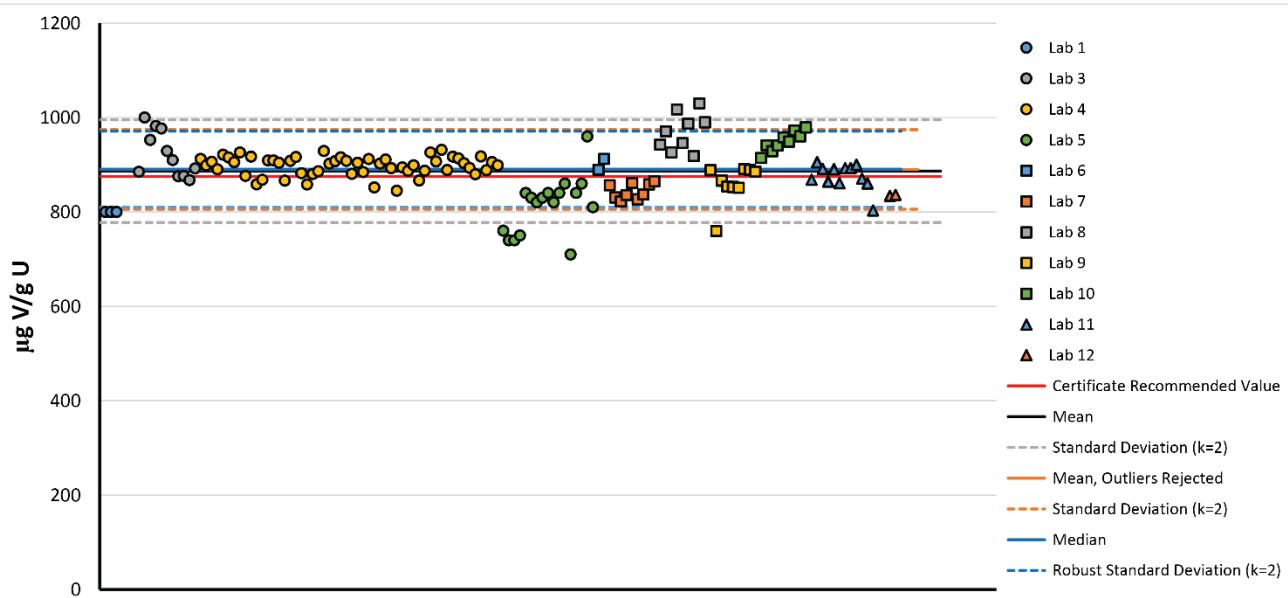
Lab #	Sample #	[Ti] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ti] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ti] ( $\mu\text{g/gU}$ )
1	1	190	4	34	226.320	7	8	258.0598
1	2	180	4	35	227.972	7	9	254.2976
1	3	170	4	36	215.617	8	1	226
3	1	236.9	4	37	225.829	8	2	237
3	2	250.0	4	38	226.266	8	3	230
3	3	259.8	4	39	228.304	8	4	236
3	4	259.0	4	40	219.896	8	5	235
3	5	261.0	4	41	223.334	8	6	238
3	6	252.8	4	42	229.890	8	7	228
3	7	247.1	4	43	222.943	8	8	226
3	8	231.8	4	44	230.799	8	9	240
3	9	232.4	4	45	221.626	9	1	267.695
3	10	227.3	4	46	226.678	9	2	199.252
3	11	232.7	4	47	226.016	9	3	198.528
4	1	223.543	4	48	225.661	9	4	187.963
4	2	220.354	4	49	220.436	9	5	221.491
4	3	224.782	4	50	218.852	9	6	208.669
4	4	220.941	4	51	232.938	9	7	211.787
4	5	225.338	4	52	225.024	9	8	203.759
4	6	243.523	4	53	224.754	9	9	235.360
4	7	209.831	4	54	223.717	10	1	220.86
4	8	254.828	5	1	179	10	2	214.94
4	9	225.386	5	2	182	10	3	231.87
4	10	214.782	5	3	192	10	4	225.26
4	11	221.463	5	4	183	10	5	218.88
4	12	219.113	5	5	210	10	6	213.63
4	13	224.839	5	6	210	10	7	226.17
4	14	226.240	5	7	210	10	8	222.62
4	15	229.492	5	8	220	10	9	227.44
4	16	207.596	5	9	220	11	1	222.50
4	17	222.700	5	10	210	11	2	225.46
4	18	225.768	5	11	220	11	3	219.87
4	19	222.674	5	12	223	11	4	222.80
4	20	212.573	5	13	199	11	5	233.60
4	21	216.120	5	14	222	11	6	222.65
4	22	218.123	5	15	220	11	7	230.77
4	23	229.022	5	16	255	11	8	222.13
4	24	223.164	5	17	211	11	9	216.52
4	25	226.008	6	1	225.0298	11	10	234.41
4	26	219.996	6	2	231.3291	11	11	236.25
4	27	223.166	7	1	248.5814	11	12	233.44
4	28	217.721	7	2	250.5525	12	1	
4	29	223.500	7	3	259.4668	12	2	
4	30	222.892	7	4	255.3817	12	3	251
4	31	227.418	7	5	254.4119	12	4	260
4	32	213.089	7	6	246.9951			
4	33	224.790	7	7	250.7695			



**Figure A13.** All Ti concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A14** All data reported for CUP-2 V concentration. Data precision as laboratory reported.

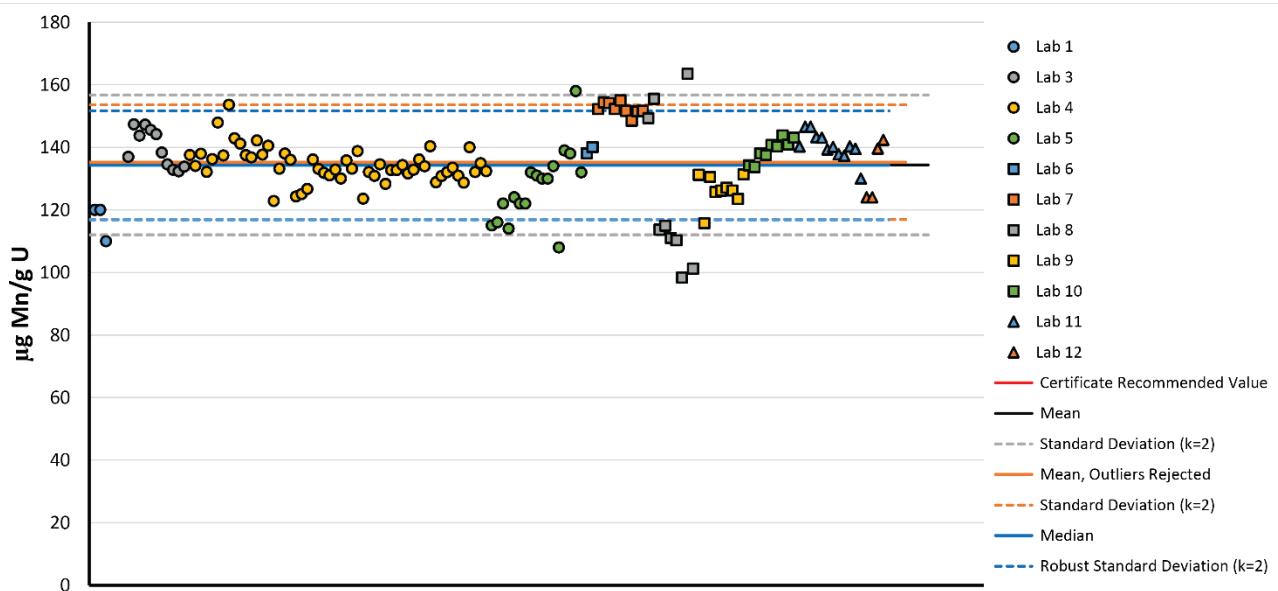
Lab #	Sample #	[V] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[V] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[V] ( $\mu\text{g/gU}$ )
1	1	800	4	34	910.992	7	8	858.1245
1	2	800	4	35	892.905	7	9	864.6586
1	3	800	4	36	844.978	8	1	942
3	1	885.1	4	37	894.285	8	2	971
3	2	999.9	4	38	887.050	8	3	926
3	3	952.5	4	39	898.759	8	4	1020
3	4	982.1	4	40	866.632	8	5	946
3	5	976.8	4	41	887.338	8	6	987
3	6	928.9	4	42	925.928	8	7	918
3	7	909.7	4	43	906.939	8	8	1030
3	8	875.5	4	44	931.427	8	9	990
3	9	876.2	4	45	888.859	9	1	888.381
3	10	867.5	4	46	917.243	9	2	759.530
3	11	892.2	4	47	913.374	9	3	866.427
4	1	912.407	4	48	903.134	9	4	853.834
4	2	898.230	4	49	893.114	9	5	852.574
4	3	906.196	4	50	880.022	9	6	851.096
4	4	890.251	4	51	917.328	9	7	890.569
4	5	921.101	4	52	888.422	9	8	889.271
4	6	915.399	4	53	905.395	9	9	885.269
4	7	905.223	4	54	898.531	10	1	914.30
4	8	926.071	5	1	760	10	2	941.01
4	9	876.198	5	2	740	10	3	928.72
4	10	917.280	5	3	740	10	4	940.54
4	11	858.453	5	4	750	10	5	957.98
4	12	867.942	5	5	840	10	6	948.64
4	13	909.156	5	6	830	10	7	972.60
4	14	908.902	5	7	820	10	8	960.21
4	15	904.197	5	8	830	10	9	979.07
4	16	866.210	5	9	840	11	1	868.34
4	17	908.377	5	10	820	11	2	905.45
4	18	916.496	5	11	840	11	3	890.90
4	19	882.039	5	12	860	11	4	864.04
4	20	857.995	5	13	710	11	5	890.36
4	21	880.114	5	14	840	11	6	860.60
4	22	886.197	5	15	860	11	7	892.35
4	23	928.859	5	16	960	11	8	892.67
4	24	902.388	5	17	810	11	9	899.63
4	25	907.542	6	1	889.2421	11	10	870.43
4	26	915.634	6	2	912.3446	11	11	860.32
4	27	908.393	7	1	856.2210	11	12	803.30
4	28	880.750	7	2	830.3393	12	1	834
4	29	904.030	7	3	822.3324	12	2	836
4	30	884.372	7	4	835.7571	12	3	
4	31	912.121	7	5	860.9361	12	4	
4	32	851.985	7	6	826.3094			
4	33	902.317	7	7	836.9067			



**Figure A14.** All V concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A15** All data reported for CUP-2 Mn concentration. Data precision as laboratory reported.

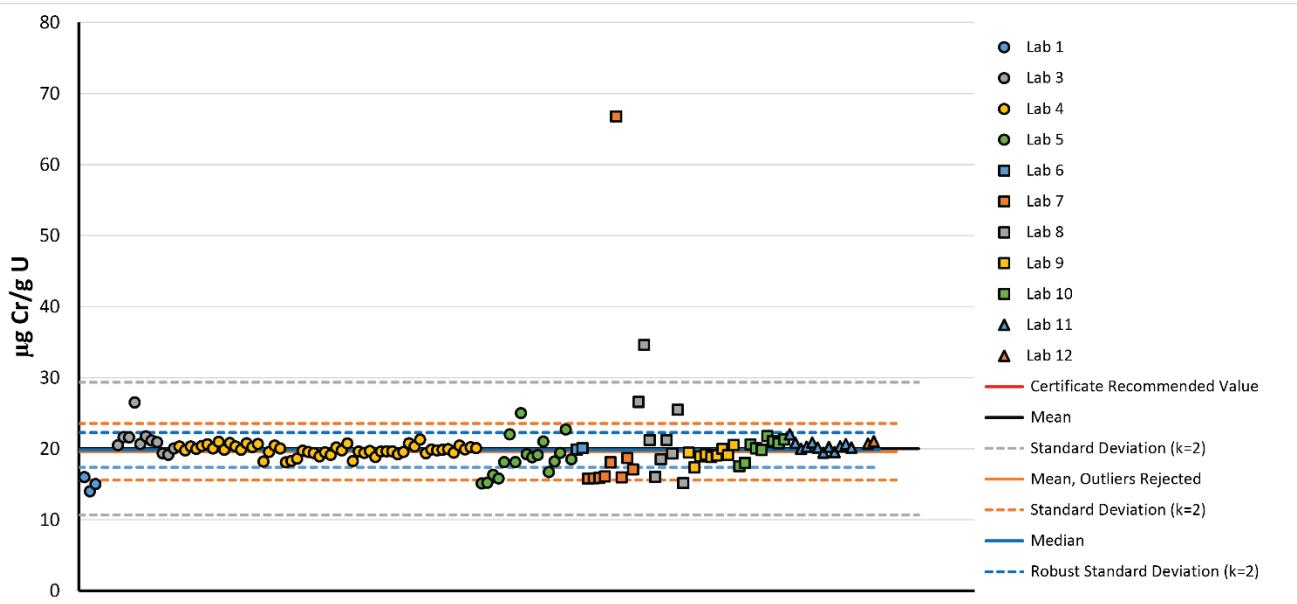
Lab #	Sample #	[Mn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mn] ( $\mu\text{g/gU}$ )
1	1	120	4	34	130.887	7	8	151.5180
1	2	120	4	35	134.555	7	9	151.6414
1	3	110	4	36	128.318	8	1	149
3	1	136.9	4	37	132.715	8	2	155
3	2	147.3	4	38	132.727	8	3	114
3	3	143.7	4	39	134.343	8	4	115
3	4	147.3	4	40	131.651	8	5	111
3	5	145.6	4	41	132.823	8	6	110
3	6	144.2	4	42	136.126	8	7	98.3
3	7	138.3	4	43	133.908	8	8	164
3	8	134.5	4	44	140.355	8	9	101
3	9	132.8	4	45	128.821	9	1	131.184
3	10	132.3	4	46	130.837	9	2	115.714
3	11	133.8	4	47	132.051	9	3	130.531
4	1	137.545	4	48	133.506	9	4	125.691
4	2	134.018	4	49	130.915	9	5	126.132
4	3	137.911	4	50	128.676	9	6	127.069
4	4	132.161	4	51	140.004	9	7	126.175
4	5	136.232	4	52	132.069	9	8	123.451
4	6	147.918	4	53	134.941	9	9	131.315
4	7	137.374	4	54	132.385	10	1	134.18
4	8	153.599	5	1	115	10	2	133.69
4	9	142.892	5	2	116	10	3	137.99
4	10	141.152	5	3	122	10	4	137.48
4	11	137.520	5	4	114	10	5	140.71
4	12	136.742	5	5	124	10	6	140.28
4	13	142.196	5	6	122	10	7	143.76
4	14	137.650	5	7	122	10	8	140.82
4	15	140.479	5	8	132	10	9	143.03
4	16	122.866	5	9	131	11	1	140.27
4	17	133.137	5	10	130	11	2	146.55
4	18	138.019	5	11	130	11	3	146.64
4	19	135.980	5	12	134	11	4	143.23
4	20	124.297	5	13	108	11	5	143.07
4	21	125.076	5	14	139	11	6	139.32
4	22	126.688	5	15	138	11	7	140.13
4	23	136.088	5	16	158	11	8	137.79
4	24	133.078	5	17	132	11	9	137.30
4	25	131.796	6	1	138.0733	11	10	140.29
4	26	131.043	6	2	140.0621	11	11	139.51
4	27	132.865	7	1	152.2188	11	12	130.05
4	28	130.024	7	2	154.3532	12	1	124
4	29	135.806	7	3	154.1547	12	2	124
4	30	133.140	7	4	152.2717	12	3	139.6
4	31	138.788	7	5	154.9984	12	4	142.4
4	32	123.547	7	6	151.6609			
4	33	132.103	7	7	148.5437			



**Figure A15.** All Mn concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A16** All data reported for CUP-2 Cr concentration. Data precision as laboratory reported.

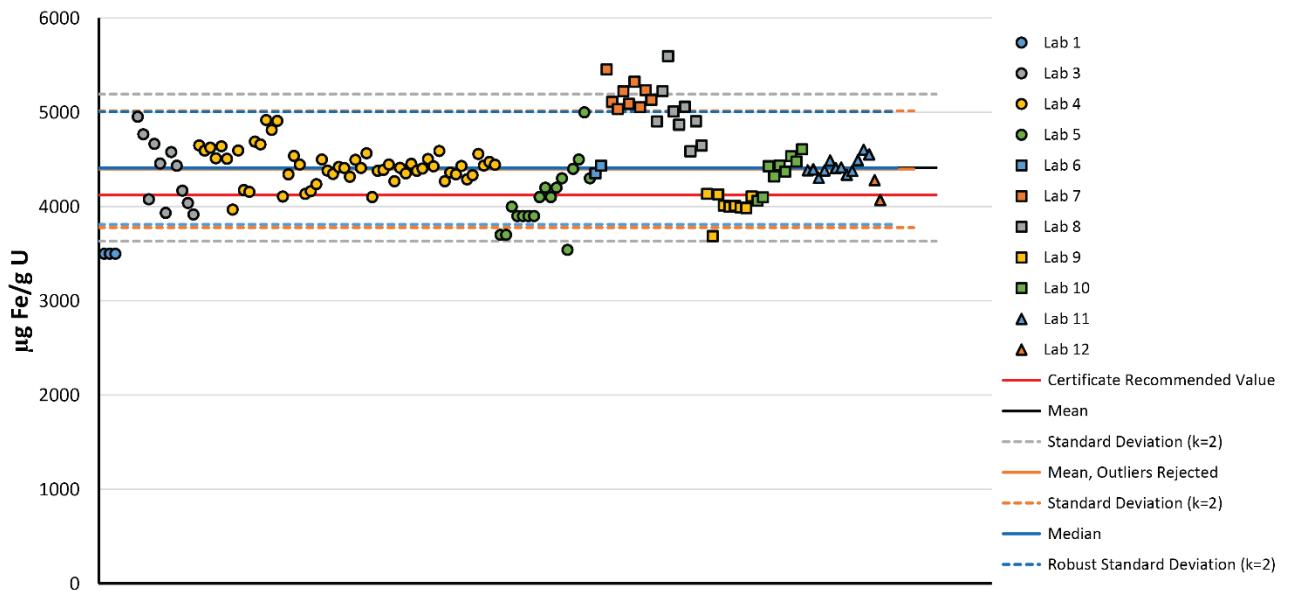
Lab #	Sample #	[Cr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cr] ( $\mu\text{g/gU}$ )
1	1	16	4	34	19.400	7	8	18.6967
1	2	14	4	35	19.681	7	9	17.0757
1	3	15	4	36	18.810	8	1	26.6
3	1	20.5	4	37	19.595	8	2	34.6
3	2	21.6	4	38	19.621	8	3	21.2
3	3	21.6	4	39	19.617	8	4	16.0
3	4	26.5	4	40	19.208	8	5	18.5
3	5	20.7	4	41	19.520	8	6	21.2
3	6	21.7	4	42	20.746	8	7	19.3
3	7	21.2	4	43	20.307	8	8	25.5
3	8	20.9	4	44	21.273	8	9	15.1
3	9	19.3	4	45	19.344	9	1	19.443
3	10	19.1	4	46	19.864	9	2	17.376
3	11	20.0	4	47	19.755	9	3	18.907
4	1	20.306	4	48	19.839	9	4	19.148
4	2	19.739	4	49	19.917	9	5	18.845
4	3	20.314	4	50	19.433	9	6	19.068
4	4	19.978	4	51	20.432	9	7	19.968
4	5	20.386	4	52	19.895	9	8	19.079
4	6	20.619	4	53	20.202	9	9	20.500
4	7	20.015	4	54	20.055	10	1	17.51
4	8	20.944	5	1	15.1	10	2	17.98
4	9	19.839	5	2	15.2	10	3	20.60
4	10	20.788	5	3	16.3	10	4	20.05
4	11	20.318	5	4	15.8	10	5	19.83
4	12	19.851	5	5	18.1	10	6	21.76
4	13	20.767	5	6	22.0	10	7	21.05
4	14	20.223	5	7	18.1	10	8	20.76
4	15	20.652	5	8	25.0	10	9	21.29
4	16	18.177	5	9	19.2	11	1	22.00
4	17	19.528	5	10	18.8	11	2	20.82
4	18	20.441	5	11	19.1	11	3	19.96
4	19	20.006	5	12	21.0	11	4	20.29
4	20	18.083	5	13	16.7	11	5	20.88
4	21	18.267	5	14	18.2	11	6	20.18
4	22	18.594	5	15	19.4	11	7	19.45
4	23	19.703	5	16	22.7	11	8	20.23
4	24	19.521	5	17	18.5	11	9	19.52
4	25	19.378	6	1	19.87691	11	10	20.34
4	26	18.908	6	2	20.06996	11	11	20.64
4	27	19.487	7	1	15.7620	11	12	20.16
4	28	19.106	7	2	15.8160	12	1	
4	29	20.173	7	3	15.8965	12	2	
4	30	19.745	7	4	16.0819	12	3	20.70
4	31	20.723	7	5	18.0771	12	4	21.02
4	32	18.238	7	6	66.7549			
4	33	19.589	7	7	15.9598			



**Figure A16.** All Cr concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A17** All data reported for CUP-2 Fe concentration. Data precision as laboratory reported.

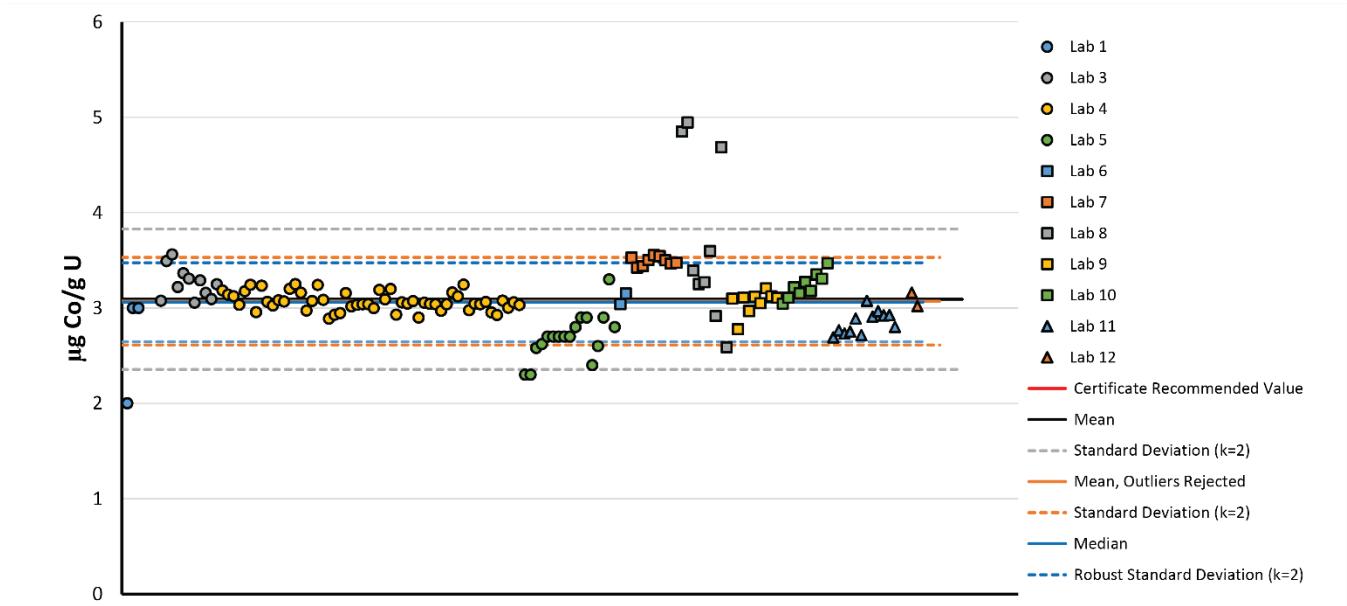
Lab #	Sample #	[Fe] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Fe] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Fe] ( $\mu\text{g/gU}$ )
1	1	3500	4	34	4387.788	7	8	5234.7399
1	2	3500	4	35	4445.457	7	9	5132.1216
1	3	3500	4	36	4268.958	8	1	4900
3	1	4953.2	4	37	4411.472	8	2	5220
3	2	4767.0	4	38	4351.866	8	3	5600
3	3	4076.8	4	39	4452.628	8	4	5010
3	4	4666.0	4	40	4379.672	8	5	4870
3	5	4456.4	4	41	4402.937	8	6	5060
3	6	3933.3	4	42	4504.457	8	7	4590
3	7	4579.2	4	43	4426.846	8	8	4910
3	8	4433.2	4	44	4589.283	8	9	4650
3	9	4168.4	4	45	4269.129	9	1	4133.488
3	10	4038.8	4	46	4360.990	9	2	3684.670
3	11	3915.6	4	47	4342.792	9	3	4128.284
4	1	4648.374	4	48	4430.179	9	4	4011.125
4	2	4592.923	4	49	4288.776	9	5	3997.965
4	3	4623.918	4	50	4332.897	9	6	4005.870
4	4	4512.534	4	51	4557.406	9	7	3989.242
4	5	4638.943	4	52	4434.474	9	8	3983.597
4	6	4507.435	4	53	4473.431	9	9	4108.543
4	7	3967.259	4	54	4444.456	10	1	4060.66
4	8	4594.536	5	1	3700	10	2	4097.92
4	9	4174.680	5	2	3700	10	3	4426.79
4	10	4156.947	5	3	4000	10	4	4318.38
4	11	4688.557	5	4	3900	10	5	4436.10
4	12	4660.536	5	5	3900	10	6	4370.40
4	13	4917.233	5	6	3900	10	7	4533.62
4	14	4812.647	5	7	3900	10	8	4477.25
4	15	4909.657	5	8	4100	10	9	4607.74
4	16	4106.707	5	9	4200	11	1	4385.43
4	17	4342.640	5	10	4100	11	2	4394.81
4	18	4537.358	5	11	4200	11	3	4302.99
4	19	4445.370	5	12	4300	11	4	4382.41
4	20	4134.549	5	13	3540	11	5	4488.80
4	21	4163.876	5	14	4400	11	6	4409.00
4	22	4236.722	5	15	4500	11	7	4416.75
4	23	4499.952	5	16	5000	11	8	4337.57
4	24	4380.348	5	17	4300	11	9	4377.94
4	25	4346.071	6	1	4351.534	11	10	4493.19
4	26	4420.209	6	2	4433.250	11	11	4602.10
4	27	4408.229	7	1	5454.1892	11	12	4551.89
4	28	4316.184	7	2	5110.4733	12	1	4280
4	29	4495.660	7	3	5034.1880	12	2	4070
4	30	4409.290	7	4	5222.8141	12	3	
4	31	4565.737	7	5	5090.0287	12	4	
4	32	4100.917	7	6	5324.4311			
4	33	4379.583	7	7	5054.3030			



**Figure A17.** All Fe concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A18** All data reported for CUP-2 Co concentration. Data precision as laboratory reported.

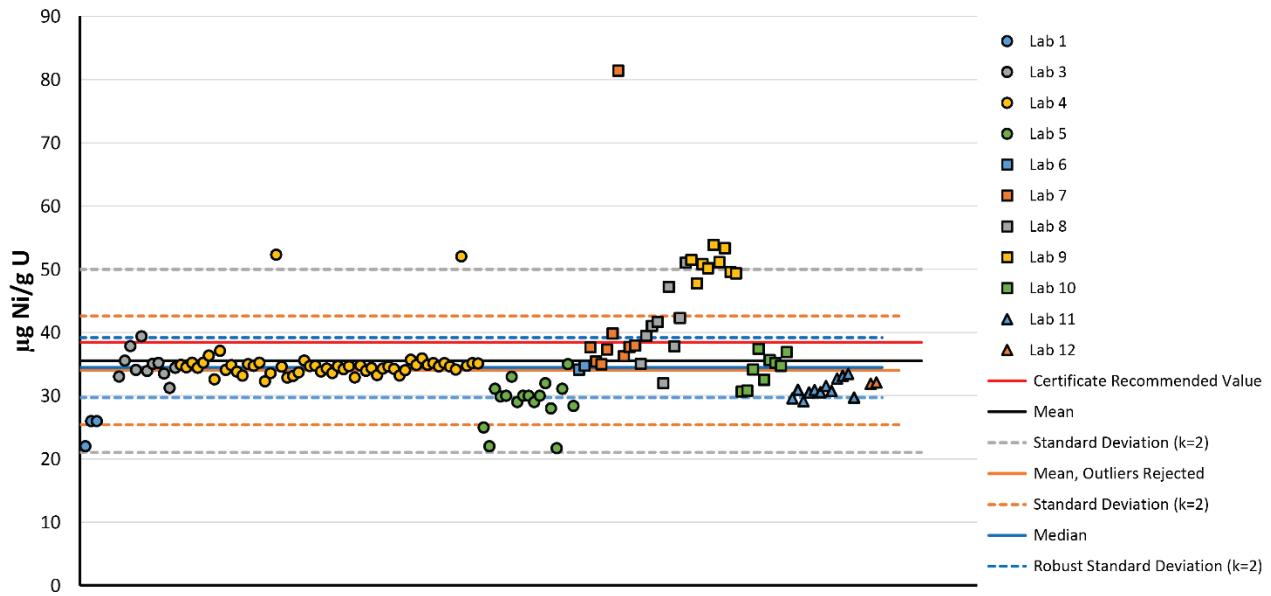
Lab #	Sample #	[Co] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Co] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Co] ( $\mu\text{g/gU}$ )
1	1	2	4	34	3.045	7	8	3.4648
1	2	3	4	35	3.072	7	9	3.4731
1	3	3	4	36	2.898	8	1	4.85
3	1	3.1	4	37	3.055	8	2	4.94
3	2	3.5	4	38	3.043	8	3	3.39
3	3	3.6	4	39	3.038	8	4	3.25
3	4	3.2	4	40	2.971	8	5	3.27
3	5	3.4	4	41	3.039	8	6	3.60
3	6	3.3	4	42	3.161	8	7	2.91
3	7	3.1	4	43	3.122	8	8	4.69
3	8	3.3	4	44	3.245	8	9	2.59
3	9	3.2	4	45	2.975	9	1	3.098
3	10	3.1	4	46	3.045	9	2	2.778
3	11	3.2	4	47	3.039	9	3	3.109
4	1	3.185	4	48	3.063	9	4	2.967
4	2	3.140	4	49	2.954	9	5	3.117
4	3	3.123	4	50	2.927	9	6	3.050
4	4	3.033	4	51	3.078	9	7	3.206
4	5	3.176	4	52	3.002	9	8	3.121
4	6	3.244	4	53	3.059	9	9	3.107
4	7	2.956	4	54	3.031	10	1	3.04
4	8	3.234	5	1	2.30	10	2	3.11
4	9	3.065	5	2	2.30	10	3	3.22
4	10	3.025	5	3	2.58	10	4	3.15
4	11	3.080	5	4	2.62	10	5	3.27
4	12	3.068	5	5	2.70	10	6	3.18
4	13	3.201	5	6	2.70	10	7	3.35
4	14	3.250	5	7	2.70	10	8	3.30
4	15	3.159	5	8	2.70	10	9	3.47
4	16	2.972	5	9	2.70	11	1	2.69
4	17	3.073	5	10	2.80	11	2	2.77
4	18	3.241	5	11	2.90	11	3	2.73
4	19	3.084	5	12	2.90	11	4	2.75
4	20	2.887	5	13	2.40	11	5	2.89
4	21	2.928	5	14	2.60	11	6	2.72
4	22	2.946	5	15	2.90	11	7	3.07
4	23	3.157	5	16	3.30	11	8	2.91
4	24	3.016	5	17	2.80	11	9	2.97
4	25	3.032	6	1	3.039973	11	10	2.92
4	26	3.038	6	2	3.150607	11	11	2.93
4	27	3.040	7	1	3.5265	11	12	2.80
4	28	2.999	7	2	3.4223	12	1	
4	29	3.190	7	3	3.4373	12	2	
4	30	3.091	7	4	3.5019	12	3	3.16
4	31	3.200	7	5	3.5534	12	4	3.02
4	32	2.931	7	6	3.5434			
4	33	3.059	7	7	3.5011			



**Figure A18.** All Co concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A19** All data reported for CUP-2 Ni concentration. Data precision as laboratory reported.

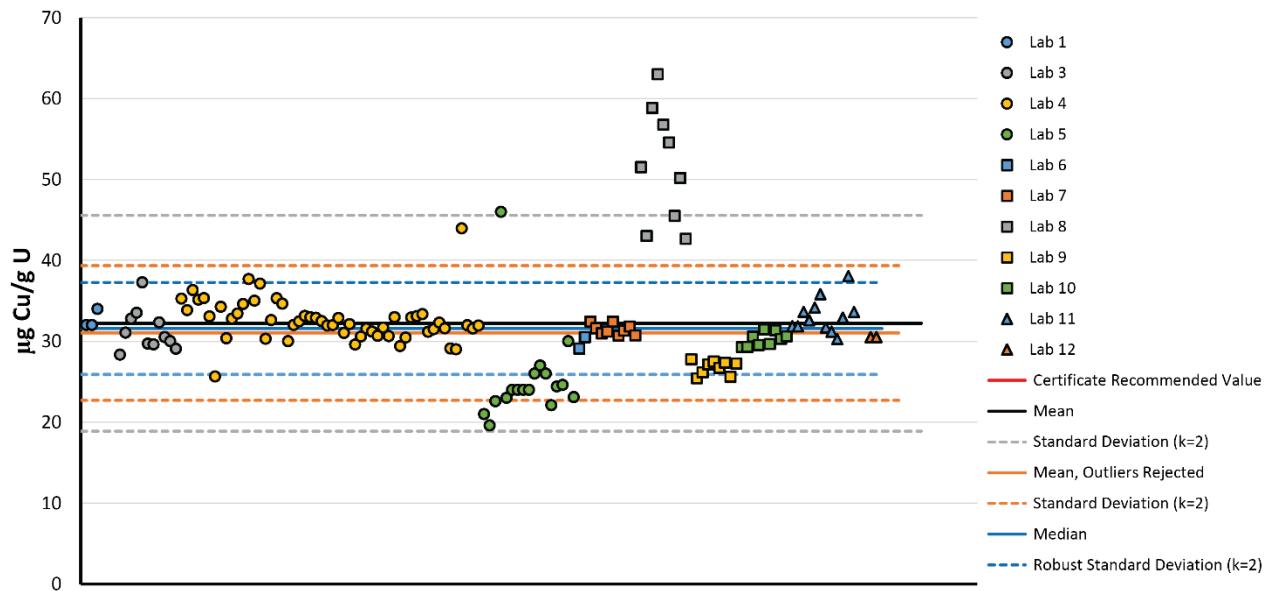
Lab #	Sample #	[Ni] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ni] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ni] ( $\mu\text{g/gU}$ )
1	1	22	4	34	33.962	7	8	37.7082
1	2	26	4	35	34.384	7	9	37.9410
1	3	26	4	36	33.270	8	1	35.1
3	1	33.0	4	37	34.286	8	2	39.5
3	2	35.6	4	38	34.615	8	3	41.0
3	3	37.9	4	39	34.253	8	4	41.7
3	4	34.1	4	40	33.213	8	5	32.0
3	5	39.4	4	41	34.040	8	6	47.2
3	6	33.9	4	42	35.702	8	7	37.8
3	7	35.1	4	43	34.873	8	8	42.3
3	8	35.2	4	44	35.922	8	9	51.0
3	9	33.5	4	45	34.898	9	1	51.491
3	10	31.3	4	46	35.166	9	2	47.767
3	11	34.4	4	47	34.657	9	3	50.811
4	1	34.891	4	48	35.166	9	4	50.157
4	2	34.502	4	49	34.606	9	5	53.851
4	3	35.222	4	50	34.134	9	6	51.125
4	4	34.411	4	51	52.029	9	7	53.325
4	5	35.215	4	52	34.756	9	8	49.586
4	6	36.369	4	53	35.173	9	9	49.347
4	7	32.588	4	54	35.126	10	1	30.67
4	8	37.100	5	1	25.0	10	2	30.80
4	9	34.081	5	2	22.0	10	3	34.15
4	10	34.841	5	3	31.1	10	4	37.40
4	11	33.810	5	4	29.9	10	5	32.53
4	12	33.182	5	5	30.0	10	6	35.63
4	13	34.996	5	6	33.0	10	7	35.20
4	14	34.733	5	7	29.0	10	8	34.73
4	15	35.228	5	8	30.0	10	9	36.91
4	16	32.305	5	9	30.0	11	1	29.62
4	17	33.557	5	10	29.0	11	2	30.93
4	18	52.319	5	11	30.0	11	3	29.14
4	19	34.590	5	12	32.0	11	4	30.53
4	20	32.878	5	13	28.0	11	5	30.91
4	21	33.135	5	14	21.7	11	6	30.58
4	22	33.711	5	15	31.1	11	7	31.59
4	23	35.575	5	16	35.0	11	8	30.78
4	24	34.713	5	17	28.4	11	9	32.75
4	25	34.748	6	1	34.11190	11	10	33.15
4	26	33.850	6	2	34.75613	11	11	33.48
4	27	34.315	7	1	37.6648	11	12	29.73
4	28	33.591	7	2	35.4215	12	1	
4	29	34.689	7	3	34.9764	12	2	
4	30	34.199	7	4	37.3059	12	3	31.9
4	31	34.672	7	5	39.8328	12	4	32.1
4	32	32.916	7	6	81.3978			
4	33	34.772	7	7	36.2427			



**Figure A19.** All Ni concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A20** All data reported for CUP-2 Cu concentration. Data precision as laboratory reported.

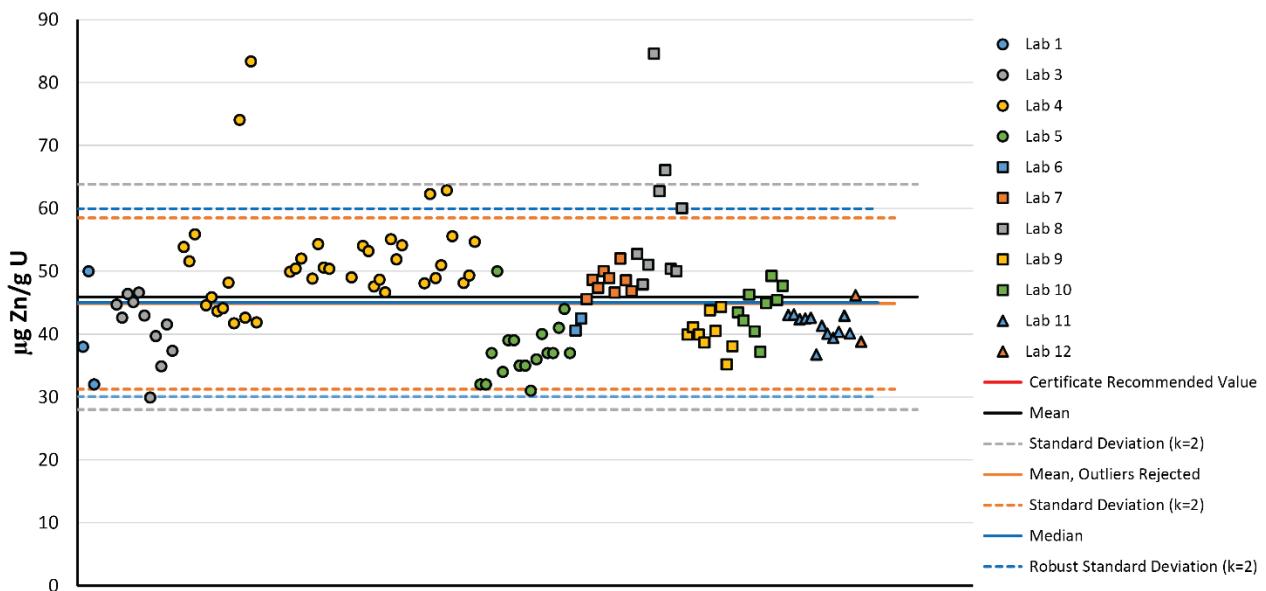
Lab #	Sample #	[Cu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cu] ( $\mu\text{g/gU}$ )
1	1	32	4	34	31.583	7	8	31.8055
1	2	32	4	35	31.196	7	9	30.7032
1	3	34	4	36	30.667	8	1	51.5
3	1	28.3	4	37	31.695	8	2	43.0
3	2	31.1	4	38	30.629	8	3	58.8
3	3	32.8	4	39	32.974	8	4	63.0
3	4	33.5	4	40	29.394	8	5	56.7
3	5	37.3	4	41	30.458	8	6	54.5
3	6	29.7	4	42	32.925	8	7	45.5
3	7	29.6	4	43	33.103	8	8	50.2
3	8	32.3	4	44	33.342	8	9	42.6
3	9	30.5	4	45	31.165	9	1	27.762
3	10	30.0	4	46	31.479	9	2	25.420
3	11	29.1	4	47	32.313	9	3	26.158
4	1	35.258	4	48	31.591	9	4	27.122
4	2	33.844	4	49	29.112	9	5	27.479
4	3	36.331	4	50	29.008	9	6	26.695
4	4	35.140	4	51	43.942	9	7	27.344
4	5	35.330	4	52	31.962	9	8	25.588
4	6	33.064	4	53	31.582	9	9	27.236
4	7	25.634	4	54	31.943	10	1	29.27
4	8	34.245	5	1	21.0	10	2	29.29
4	9	30.375	5	2	19.6	10	3	30.56
4	10	32.793	5	3	22.6	10	4	29.53
4	11	33.441	5	4	46.0	10	5	31.46
4	12	34.600	5	5	23.0	10	6	29.66
4	13	37.677	5	6	24.0	10	7	31.33
4	14	35.003	5	7	24.0	10	8	30.29
4	15	37.115	5	8	24.0	10	9	30.60
4	16	30.304	5	9	24.0	11	1	31.86
4	17	32.612	5	10	26.0	11	2	31.83
4	18	35.308	5	11	27.0	11	3	33.63
4	19	34.635	5	12	26.0	11	4	32.58
4	20	29.998	5	13	22.1	11	5	34.15
4	21	32.001	5	14	24.4	11	6	35.81
4	22	32.465	5	15	24.6	11	7	31.68
4	23	33.121	5	16	30.0	11	8	31.17
4	24	32.959	5	17	23.1	11	9	30.26
4	25	32.886	6	1	29.10216	11	10	32.91
4	26	32.484	6	2	30.50268	11	11	38.06
4	27	31.944	7	1	32.4130	11	12	33.61
4	28	31.997	7	2	31.5951	12	1	
4	29	32.867	7	3	30.9680	12	2	
4	30	31.044	7	4	31.1970	12	3	30.50
4	31	32.114	7	5	32.4286	12	4	30.52
4	32	29.588	7	6	30.7000			
4	33	30.585	7	7	31.2979			



**Figure A20.** All Cu concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A21** All data reported for CUP-2 Zn concentration. Data precision as laboratory reported.

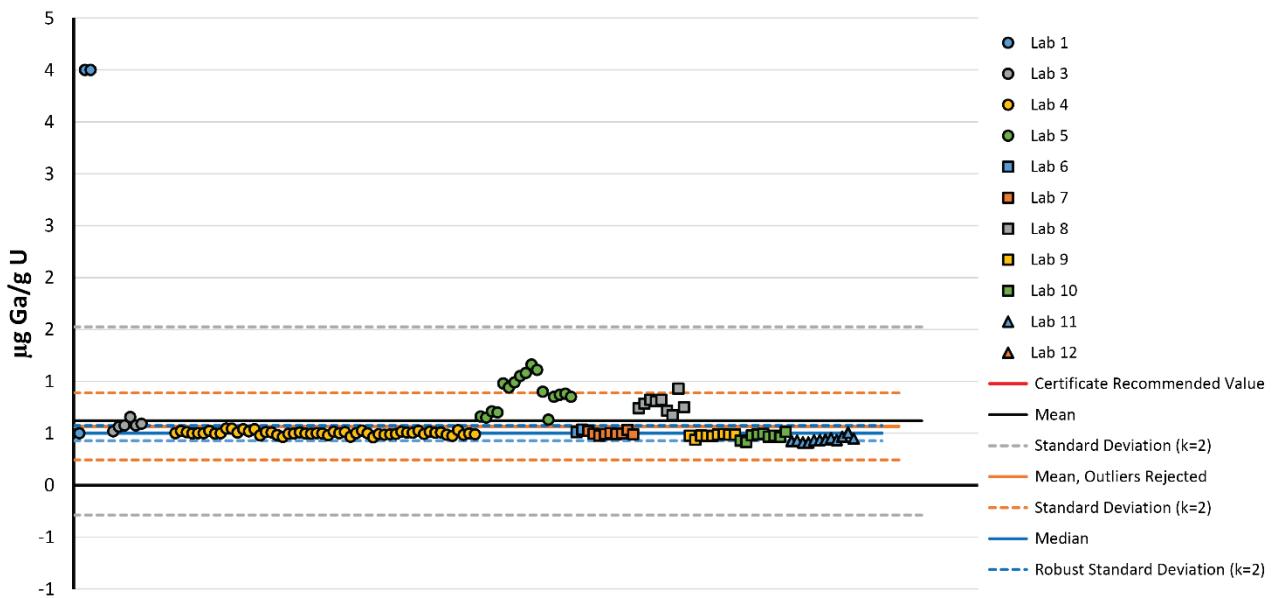
Lab #	Sample #	[Zn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Zn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Zn] ( $\mu\text{g/gU}$ )
1	1	38	4	34	54.029	7	8	48.5536
1	2	50	4	35	53.208	7	9	46.8230
1	3	32	4	36	47.580	8	1	52.7
3	1	44.7	4	37	48.655	8	2	47.9
3	2	42.6	4	38	46.630	8	3	51.0
3	3	46.4	4	39	55.085	8	4	84.6
3	4	45.1	4	40	51.873	8	5	62.7
3	5	46.6	4	41	54.134	8	6	66.1
3	6	42.9	4	42		8	7	50.4
3	7	29.9	4	43		8	8	50.0
3	8	39.7	4	44		8	9	60.0
3	9	34.9	4	45	48.093	9	1	39.919
3	10	41.5	4	46	62.267	9	2	41.083
3	11	37.3	4	47	48.914	9	3	39.915
4	1		4	48	50.968	9	4	38.666
4	2	53.852	4	49	62.857	9	5	43.768
4	3	51.578	4	50	55.578	9	6	40.506
4	4	55.885	4	51		9	7	44.301
4	5		4	52	48.139	9	8	35.175
4	6	44.578	4	53	49.327	9	9	38.065
4	7	45.852	4	54	54.677	10	1	43.46
4	8	43.651	5	1	32	10	2	42.15
4	9	44.125	5	2	32	10	3	46.27
4	10	48.182	5	3	37	10	4	40.42
4	11	41.737	5	4	50	10	5	37.18
4	12	74.061	5	5	34	10	6	44.96
4	13	42.622	5	6	39	10	7	49.25
4	14	83.352	5	7	39	10	8	45.43
4	15	41.868	5	8	35	10	9	47.66
4	16		5	9	35	11	1	43.04
4	17		5	10	31	11	2	43.14
4	18		5	11	36	11	3	42.36
4	19		5	12	40	11	4	42.51
4	20		5	13	37	11	5	42.58
4	21	49.914	5	14	37	11	6	36.76
4	22	50.448	5	15	41	11	7	41.34
4	23	52.018	5	16	44	11	8	40.05
4	24		5	17	37	11	9	39.41
4	25	48.834	6	1	40.55334	11	10	40.36
4	26	54.314	6	2	42.47984	11	11	42.93
4	27	50.584	7	1	45.5561	11	12	40.13
4	28	50.374	7	2	48.6451	12	1	46.2
4	29		7	3	47.3378	12	2	38.8
4	30		7	4	49.9979	12	3	
4	31		7	5	48.9046	12	4	
4	32	49.013	7	6	46.6101			
4	33		7	7	52.0275			



**Figure A21.** All Zn concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A22** All data reported for CUP-2 Ga concentration. Data precision as laboratory reported.

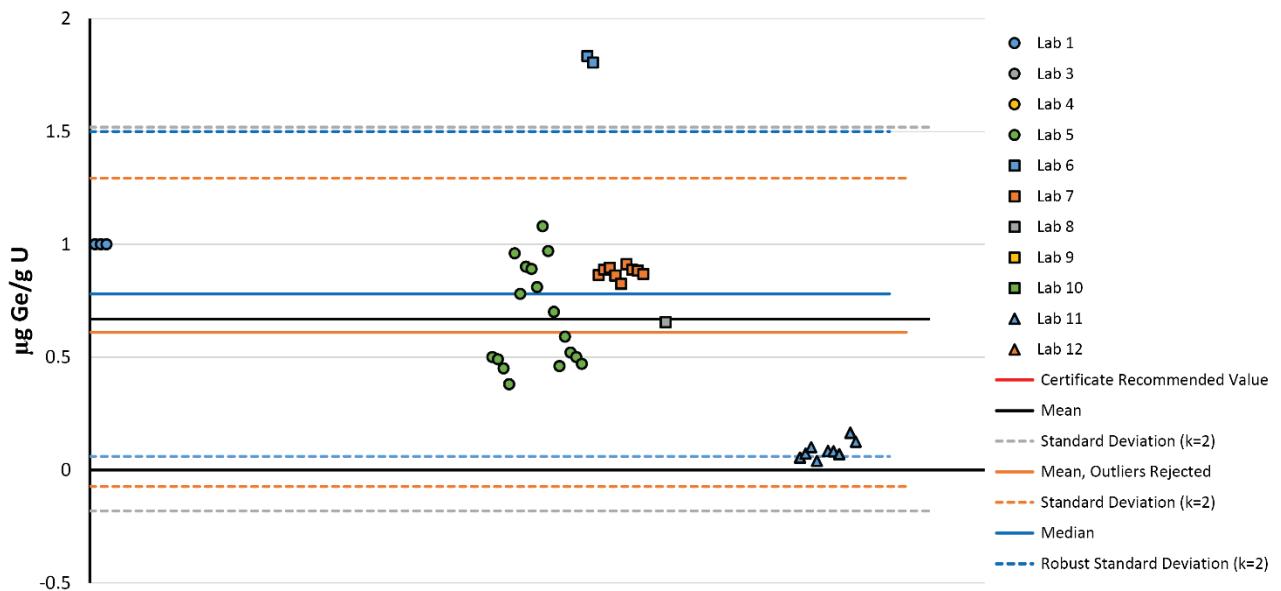
Lab #	Sample #	[Ga] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ga] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ga] ( $\mu\text{g/gU}$ )
1	1	1	4	34	0.525	7	8	0.5307
1	2	4	4	35	0.500	7	9	0.4896
1	3	4	4	36	0.460	8	1	0.740
3	1	0.5	4	37	0.491	8	2	0.784
3	2	0.6	4	38	0.486	8	3	0.821
3	3	0.6	4	39	0.490	8	4	0.809
3	4	0.7	4	40	0.493	8	5	0.821
3	5	0.6	4	41	0.514	8	6	0.716
3	6	0.6	4	42	0.505	8	7	0.674
3	7		4	43	0.505	8	8	0.928
3	8		4	44	0.524	8	9	0.750
3	9		4	45	0.493	9	1	0.476
3	10		4	46	0.514	9	2	0.435
3	11		4	47	0.505	9	3	0.478
4	1	0.502	4	48	0.507	9	4	0.473
4	2	0.521	4	49	0.486	9	5	0.472
4	3	0.509	4	50	0.473	9	6	0.486
4	4	0.497	4	51	0.530	9	7	0.490
4	5	0.501	4	52	0.484	9	8	0.484
4	6	0.499	4	53	0.497	9	9	0.486
4	7	0.521	4	54	0.489	10	1	0.43
4	8	0.495	5	1	0.66	10	2	0.42
4	9	0.500	5	2	0.65	10	3	0.48
4	10	0.546	5	3	0.71	10	4	0.49
4	11	0.544	5	4	0.70	10	5	0.49
4	12	0.506	5	5	0.98	10	6	0.47
4	13	0.538	5	6	0.94	10	7	0.47
4	14	0.519	5	7	0.99	10	8	0.46
4	15	0.539	5	8	1.05	10	9	0.51
4	16	0.479	5	9	1.08	11	1	0.43
4	17	0.510	5	10	1.16	11	2	0.43
4	18	0.507	5	11	1.11	11	3	0.41
4	19	0.482	5	12	0.90	11	4	0.41
4	20	0.464	5	13	0.63	11	5	0.43
4	21	0.493	5	14	0.85	11	6	0.44
4	22	0.497	5	15	0.87	11	7	0.44
4	23	0.508	5	16	0.88	11	8	0.45
4	24	0.498	5	17	0.85	11	9	0.43
4	25	0.493	6	1	0.511565	11	10	0.47
4	26	0.501	6	2	0.533484	11	11	0.50
4	27	0.497	7	1	0.5237	11	12	0.45
4	28	0.481	7	2	0.4935	12	1	
4	29	0.514	7	3	0.4754	12	2	
4	30	0.501	7	4	0.4908	12	3	
4	31	0.510	7	5	0.4996	12	4	
4	32	0.466	7	6	0.4923			
4	33	0.501	7	7	0.4984			



**Figure A22.** All Ga concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A23** All data reported for CUP-2 Ge concentration. Data precision as laboratory reported.

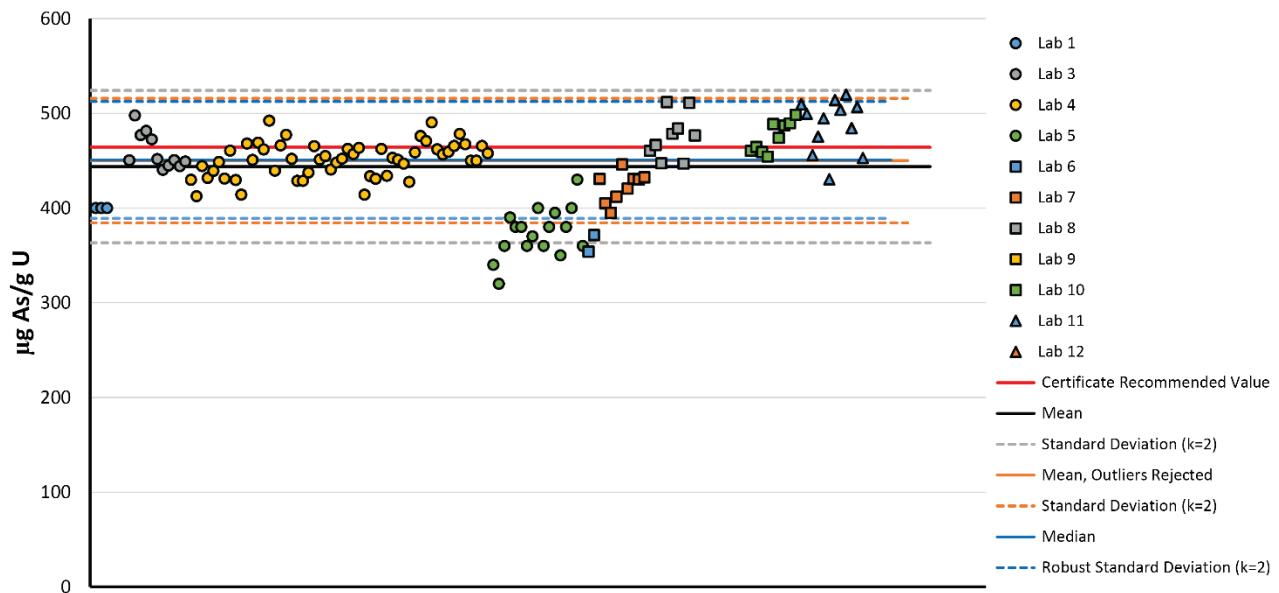
Lab #	Sample #	[Ge] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ge] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ge] ( $\mu\text{g/gU}$ )
1	1	1	4	34		7	8	0.8833
1	2	1	4	35		7	9	0.8683
1	3	1	4	36		8	1	
3	1		4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	0.655
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	
3	10		4	46		9	2	
3	11		4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	
4	8		5	1	0.50	10	2	
4	9		5	2	0.49	10	3	
4	10		5	3	0.45	10	4	
4	11		5	4	0.38	10	5	
4	12		5	5	0.96	10	6	
4	13		5	6	0.78	10	7	
4	14		5	7	0.90	10	8	
4	15		5	8	0.89	10	9	
4	16		5	9	0.81	11	1	0.06
4	17		5	10	1.08	11	2	0.07
4	18		5	11	0.97	11	3	0.10
4	19		5	12	0.70	11	4	0.04
4	20		5	13	0.46	11	5	
4	21		5	14	0.59	11	6	0.08
4	22		5	15	0.52	11	7	0.08
4	23		5	16	0.50	11	8	0.07
4	24		5	17	0.47	11	9	
4	25		6	1	1.833621	11	10	0.16
4	26		6	2	1.805027	11	11	0.12
4	27		7	1	0.8634	11	12	
4	28		7	2	0.8875	12	1	
4	29		7	3	0.8959	12	2	
4	30		7	4	0.8609	12	3	
4	31		7	5	0.8247	12	4	
4	32		7	6	0.9119			
4	33		7	7	0.8875			



**Figure A23.** All Ge concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A24** All data reported for CUP-2 As concentration. Data precision as laboratory reported.

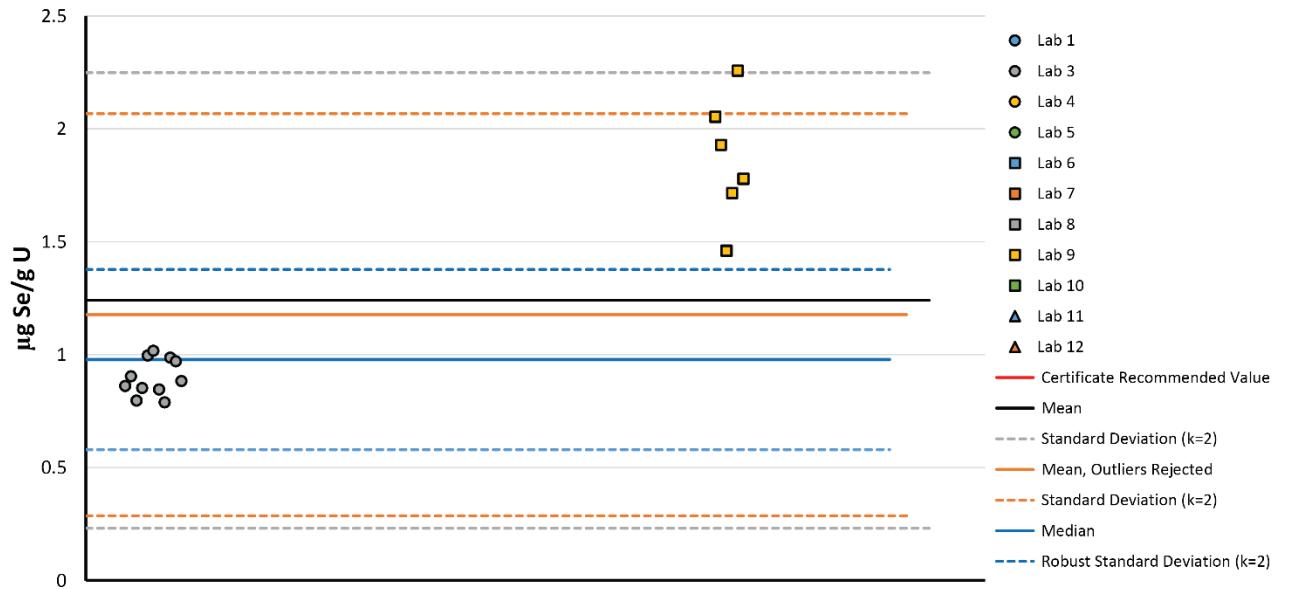
Lab #	Sample #	[As] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[As] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[As] ( $\mu\text{g/gU}$ )
1	1	400	4	34	430.811	7	8	430.1630
1	2	400	4	35	462.409	7	9	432.4009
1	3	400	4	36	434.036	8	1	460
3	1	450.5	4	37	452.959	8	2	466
3	2	497.8	4	38	450.733	8	3	447
3	3	476.9	4	39	446.930	8	4	512
3	4	481.4	4	40	427.636	8	5	478
3	5	472.6	4	41	458.662	8	6	484
3	6	451.7	4	42	476.062	8	7	447
3	7	440.2	4	43	470.666	8	8	511
3	8	445.0	4	44	490.451	8	9	476
3	9	450.6	4	45	462.041	9	1	
3	10	444.2	4	46	456.395	9	2	
3	11	449.2	4	47	459.334	9	3	
4	1	429.788	4	48	465.500	9	4	
4	2	412.448	4	49	478.145	9	5	
4	3	444.399	4	50	467.415	9	6	
4	4	431.744	4	51	449.958	9	7	
4	5	439.169	4	52	450.098	9	8	
4	6	448.506	4	53	465.465	9	9	
4	7	431.083	4	54	457.735	10	1	460.28
4	8	460.592	5	1	340	10	2	464.42
4	9	429.504	5	2	320	10	3	459.11
4	10	414.145	5	3	360	10	4	454.29
4	11	468.059	5	4	390	10	5	488.59
4	12	450.777	5	5	380	10	6	473.97
4	13	469.036	5	6	380	10	7	487.01
4	14	461.903	5	7	360	10	8	489.54
4	15	492.233	5	8	370	10	9	498.21
4	16	439.423	5	9	400	11	1	509.53
4	17	465.980	5	10	360	11	2	499.48
4	18	477.217	5	11	380	11	3	455.90
4	19	451.895	5	12	395	11	4	475.29
4	20	428.698	5	13	350	11	5	494.67
4	21	428.657	5	14	380	11	6	430.29
4	22	437.591	5	15	400	11	7	513.93
4	23	465.415	5	16	430	11	8	503.69
4	24	451.151	5	17	360	11	9	519.74
4	25	454.835	6	1	353.8274	11	10	484.22
4	26	440.676	6	2	371.3313	11	11	506.58
4	27	448.074	7	1	430.6500	11	12	452.75
4	28	451.979	7	2	404.9488	12	1	
4	29	462.441	7	3	394.8463	12	2	
4	30	456.844	7	4	411.9039	12	3	
4	31	463.458	7	5	446.0332	12	4	
4	32	414.076	7	6	420.4762			
4	33	433.676	7	7	430.6212			



**Figure A24.** All As concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A25** All data reported for CUP-2 Se concentration. Data precision as laboratory reported.

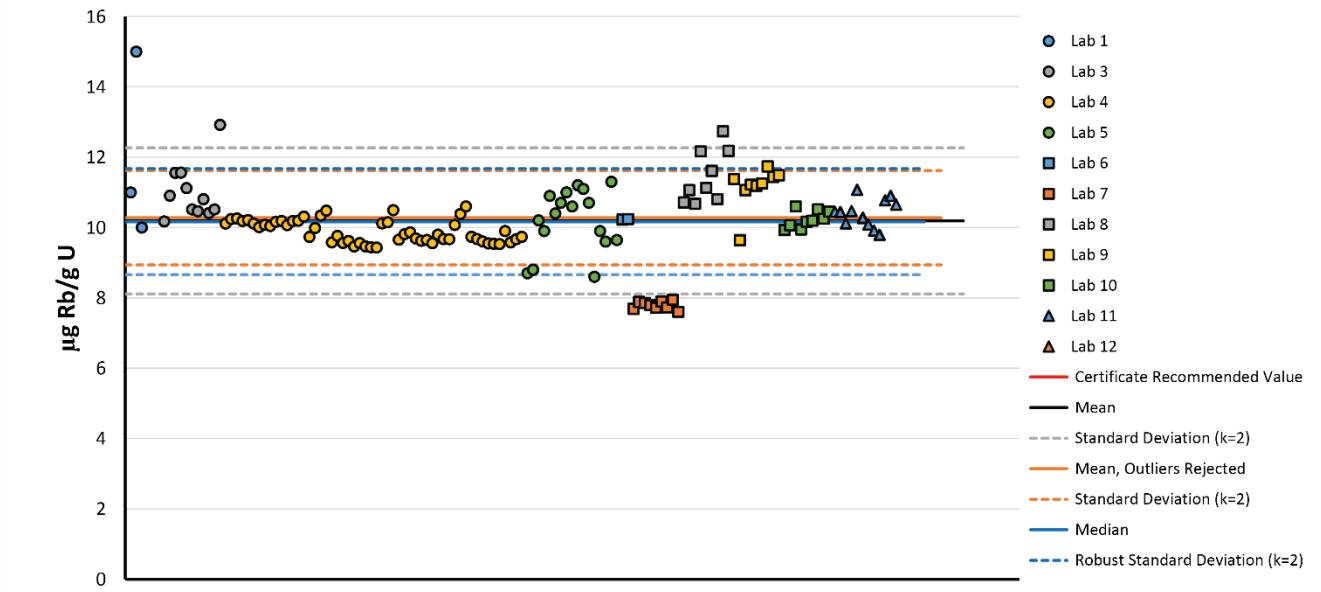
Lab #	Sample #	[Se] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Se] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Se] ( $\mu\text{g/gU}$ )
1	1		4	34		7	8	
1	2		4	35		7	9	
1	3		4	36		8	1	
3	1	0.9	4	37		8	2	
3	2	0.9	4	38		8	3	
3	3	0.8	4	39		8	4	
3	4	0.9	4	40		8	5	
3	5	1.0	4	41		8	6	
3	6	1.0	4	42		8	7	
3	7	0.8	4	43		8	8	
3	8	0.8	4	44		8	9	
3	9	1.0	4	45		9	1	
3	10	1.0	4	46		9	2	
3	11	0.9	4	47		9	3	
4	1		4	48		9	4	2.052
4	2		4	49		9	5	1.928
4	3		4	50		9	6	1.459
4	4		4	51		9	7	1.715
4	5		4	52		9	8	2.257
4	6		4	53		9	9	1.778
4	7		4	54		10	1	
4	8		5	1		10	2	
4	9		5	2		10	3	
4	10		5	3		10	4	
4	11		5	4		10	5	
4	12		5	5		10	6	
4	13		5	6		10	7	
4	14		5	7		10	8	
4	15		5	8		10	9	
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1		11	10	
4	26		6	2		11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A25.** All Se concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A26** All data reported for CUP-2 Rb concentration. Data precision as laboratory reported.

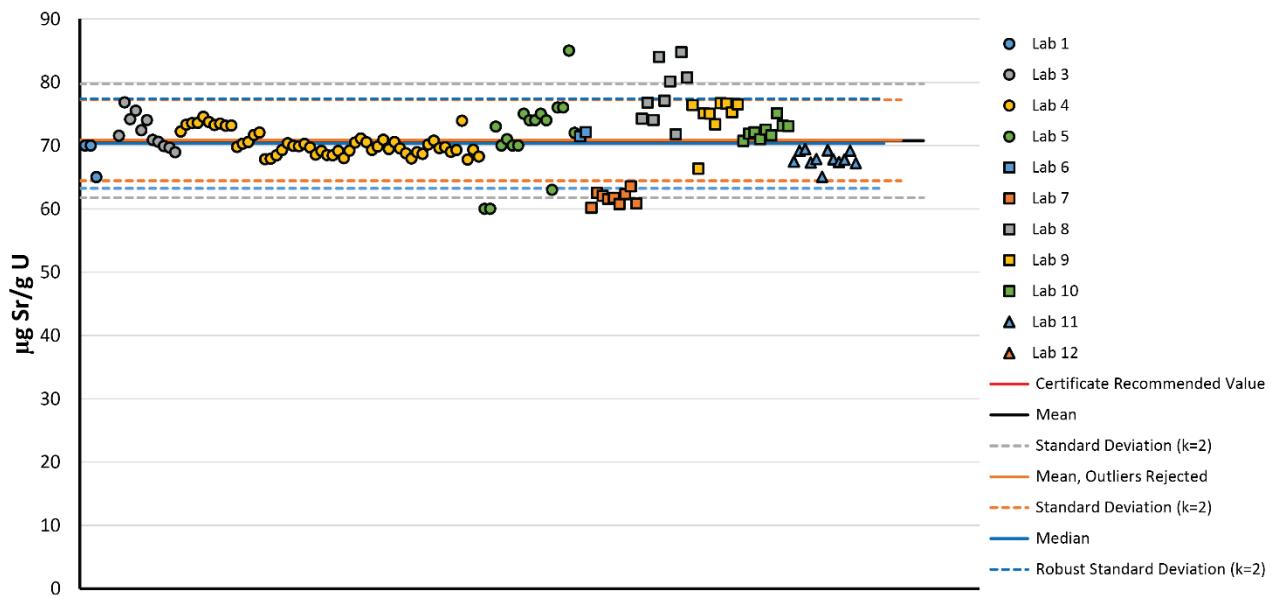
Lab #	Sample #	[Rb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Rb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Rb] ( $\mu\text{g/gU}$ )
1	1	11	4	34	9.863	7	8	7.9466
1	2	15	4	35	9.693	7	9	7.6040
1	3	10	4	36	9.623	8	1	10.7
3	1	10.2	4	37	9.648	8	2	11.1
3	2	10.9	4	38	9.554	8	3	10.7
3	3	11.6	4	39	9.797	8	4	12.2
3	4	11.6	4	40	9.674	8	5	11.1
3	5	11.1	4	41	9.668	8	6	11.6
3	6	10.5	4	42	10.071	8	7	10.8
3	7	10.5	4	43	10.387	8	8	12.7
3	8	10.8	4	44	10.597	8	9	12.2
3	9	10.4	4	45	9.738	9	1	11.374
3	10	10.5	4	46	9.671	9	2	9.638
3	11	12.9	4	47	9.603	9	3	11.062
4	1	10.113	4	48	9.548	9	4	11.216
4	2	10.240	4	49	9.538	9	5	11.187
4	3	10.257	4	50	9.527	9	6	11.253
4	4	10.187	4	51	9.902	9	7	11.736
4	5	10.214	4	52	9.580	9	8	11.437
4	6	10.111	4	53	9.666	9	9	11.482
4	7	10.009	4	54	9.735	10	1	9.93
4	8	10.076	5	1	8.7	10	2	10.06
4	9	10.043	5	2	8.8	10	3	10.60
4	10	10.160	5	3	10.2	10	4	9.95
4	11	10.189	5	4	9.9	10	5	10.16
4	12	10.068	5	5	10.9	10	6	10.19
4	13	10.182	5	6	10.4	10	7	10.52
4	14	10.192	5	7	10.7	10	8	10.25
4	15	10.310	5	8	11.0	10	9	10.45
4	16	9.731	5	9	10.6	11	1	10.45
4	17	9.984	5	10	11.2	11	2	10.44
4	18	10.339	5	11	11.1	11	3	10.12
4	19	10.478	5	12	10.7	11	4	10.47
4	20	9.576	5	13	8.6	11	5	11.07
4	21	9.760	5	14	9.9	11	6	10.28
4	22	9.557	5	15	9.6	11	7	10.08
4	23	9.619	5	16	11.3	11	8	9.91
4	24	9.457	5	17	9.6	11	9	9.79
4	25	9.558	6	1	10.22782	11	10	10.78
4	26	9.464	6	2	10.23703	11	11	10.90
4	27	9.437	7	1	7.6879	11	12	10.65
4	28	9.428	7	2	7.8826	12	1	
4	29	10.117	7	3	7.8541	12	2	
4	30	10.146	7	4	7.7896	12	3	
4	31	10.493	7	5	7.7234	12	4	
4	32	9.653	7	6	7.8948			
4	33	9.809	7	7	7.7250			



**Figure A26.** All Rb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A27** All data reported for CUP-2 Sr concentration. Data precision as laboratory reported.

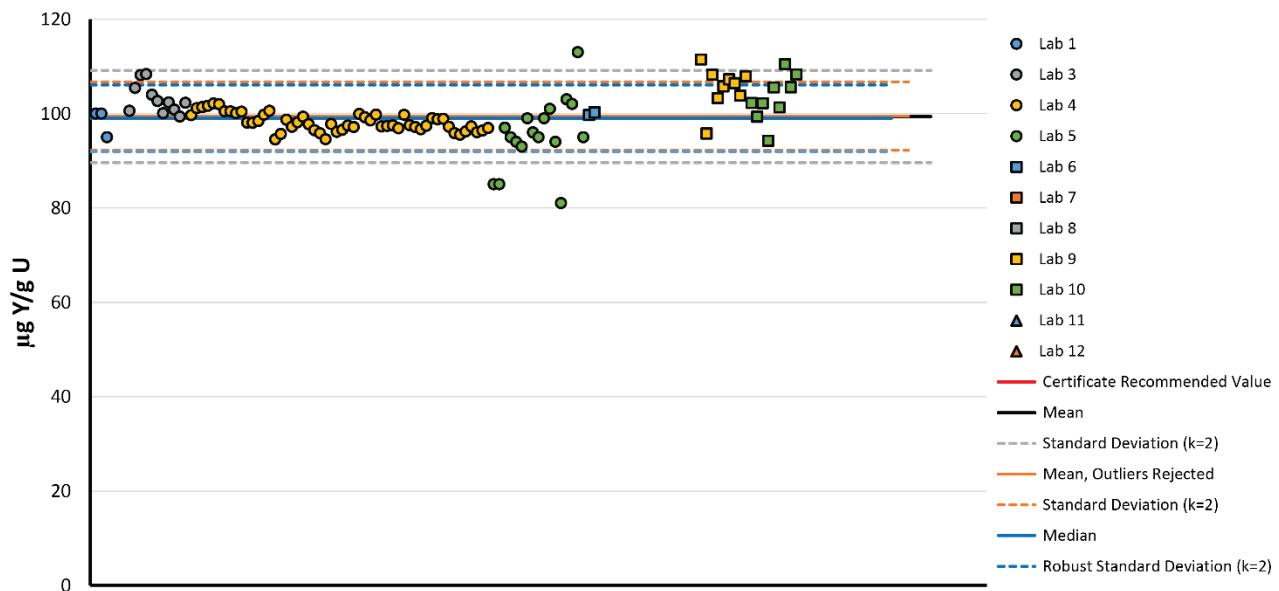
Lab #	Sample #	[Sr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sr] ( $\mu\text{g/gU}$ )
1	1	70	4	34	70.536	7	8	63.5320
1	2	70	4	35	69.316	7	9	60.8377
1	3	65	4	36	69.824	8	1	74.2
3	1	71.6	4	37	70.908	8	2	76.8
3	2	76.8	4	38	69.439	8	3	74.0
3	3	74.2	4	39	70.561	8	4	84.0
3	4	75.5	4	40	69.525	8	5	77.1
3	5	72.4	4	41	68.790	8	6	80.1
3	6	74.0	4	42	67.963	8	7	71.8
3	7	70.9	4	43	68.942	8	8	84.7
3	8	70.6	4	44	68.664	8	9	80.7
3	9	69.9	4	45	70.173	9	1	76.386
3	10	69.7	4	46	70.778	9	2	66.352
3	11	69.0	4	47	69.572	9	3	75.080
4	1	72.218	4	48	69.761	9	4	75.054
4	2	73.283	4	49	69.004	9	5	73.340
4	3	73.557	4	50	69.288	9	6	76.691
4	4	73.562	4	51	73.908	9	7	76.608
4	5	74.547	4	52	67.777	9	8	75.225
4	6	73.718	4	53	69.338	9	9	76.509
4	7	73.234	4	54	68.257	10	1	70.72
4	8	73.464	5	1	60	10	2	71.85
4	9	73.135	5	2	60	10	3	72.08
4	10	73.152	5	3	73	10	4	70.98
4	11	69.771	5	4	70	10	5	72.51
4	12	70.296	5	5	71	10	6	71.61
4	13	70.560	5	6	70	10	7	75.10
4	14	71.675	5	7	70	10	8	73.14
4	15	72.039	5	8	75	10	9	73.07
4	16	67.849	5	9	74	11	1	67.45
4	17	67.916	5	10	74	11	2	69.16
4	18	68.459	5	11	75	11	3	69.46
4	19	69.289	5	12	74	11	4	67.30
4	20	70.353	5	13	63	11	5	67.87
4	21	69.941	5	14	76	11	6	65.08
4	22	69.887	5	15	76	11	7	69.24
4	23	70.238	5	16	85	11	8	67.84
4	24	69.708	5	17	72	11	9	67.39
4	25	68.550	6	1	71.45564	11	10	67.79
4	26	69.151	6	2	72.11393	11	11	69.17
4	27	68.503	7	1	60.1734	11	12	67.22
4	28	68.458	7	2	62.5162	12	1	
4	29	69.139	7	3	62.0587	12	2	
4	30	67.997	7	4	61.5386	12	3	
4	31	69.195	7	5	61.7034	12	4	
4	32	70.483	7	6	60.7369			
4	33	71.104	7	7	62.3329			



**Figure A27.** All Sr concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A28** All data reported for CUP-2 Y concentration. Data precision as laboratory reported.

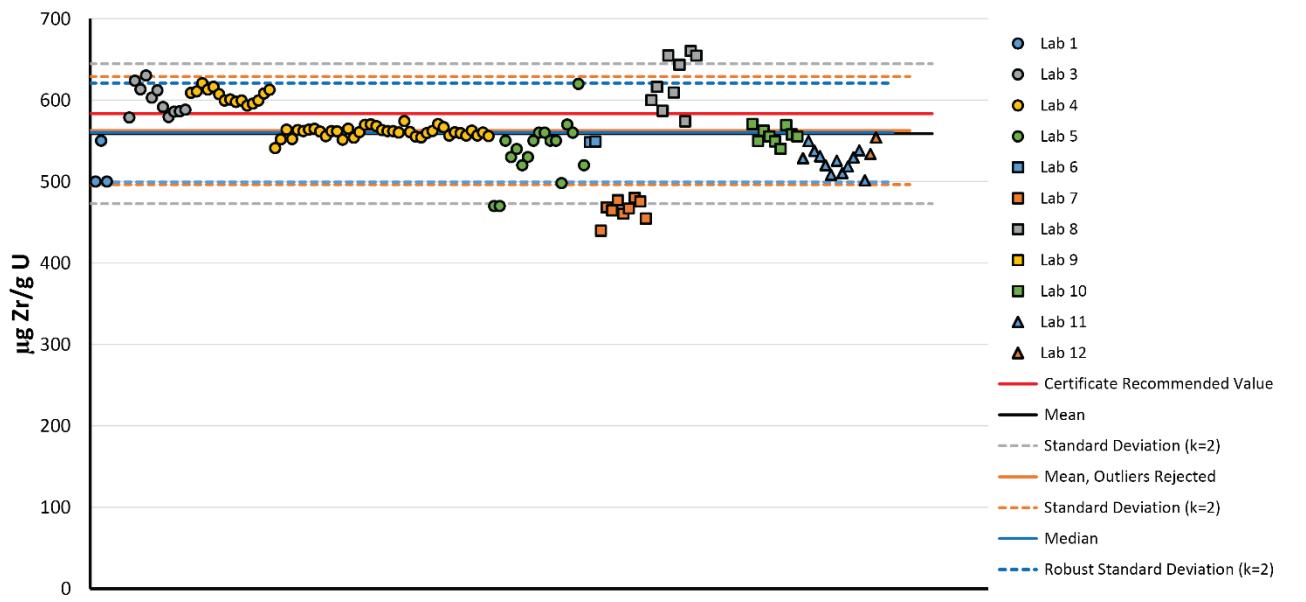
Lab #	Sample #	[Y] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Y] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Y] ( $\mu\text{g/gU}$ )
1	1	100	4	34	99.773	7	8	
1	2	100	4	35	97.233	7	9	
1	3	95	4	36	97.350	8	1	
3	1	100.6	4	37	97.479	8	2	
3	2	105.4	4	38	96.877	8	3	
3	3	108.2	4	39	99.710	8	4	
3	4	108.3	4	40	97.505	8	5	
3	5	104.0	4	41	97.154	8	6	
3	6	102.7	4	42	96.673	8	7	
3	7	100.0	4	43	97.385	8	8	
3	8	102.3	4	44	99.027	8	9	
3	9	100.9	4	45	98.769	9	1	111.463
3	10	99.4	4	46	98.893	9	2	95.730
3	11	102.3	4	47	97.210	9	3	108.214
4	1	99.648	4	48	95.834	9	4	103.223
4	2	101.124	4	49	95.504	9	5	105.736
4	3	101.364	4	50	96.161	9	6	107.219
4	4	101.661	4	51	97.238	9	7	106.415
4	5	102.137	4	52	96.021	9	8	103.810
4	6	101.974	4	53	96.399	9	9	107.875
4	7	100.469	4	54	96.916	10	1	102.22
4	8	100.483	5	1	85	10	2	99.31
4	9	100.066	5	2	85	10	3	102.16
4	10	100.382	5	3	97	10	4	94.23
4	11	98.068	5	4	95	10	5	105.54
4	12	98.008	5	5	94	10	6	101.27
4	13	98.380	5	6	93	10	7	110.44
4	14	99.720	5	7	99	10	8	105.58
4	15	100.595	5	8	96	10	9	108.27
4	16	94.516	5	9	95	11	1	
4	17	95.649	5	10	99	11	2	
4	18	98.706	5	11	101	11	3	
4	19	97.191	5	12	94	11	4	
4	20	98.137	5	13	81	11	5	
4	21	99.333	5	14	103	11	6	
4	22	97.719	5	15	102	11	7	
4	23	96.456	5	16	113	11	8	
4	24	95.809	5	17	95	11	9	
4	25	94.542	6	1	99.69092	11	10	
4	26	97.768	6	2	100.2576	11	11	
4	27	96.119	7	1		11	12	
4	28	96.538	7	2		12	1	
4	29	97.451	7	3		12	2	
4	30	97.139	7	4		12	3	
4	31	99.899	7	5		12	4	
4	32	99.221	7	6				
4	33	98.543	7	7				



**Figure A28.** All Y concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A29** All data reported for CUP-2 Zr concentration. Data precision as laboratory reported.

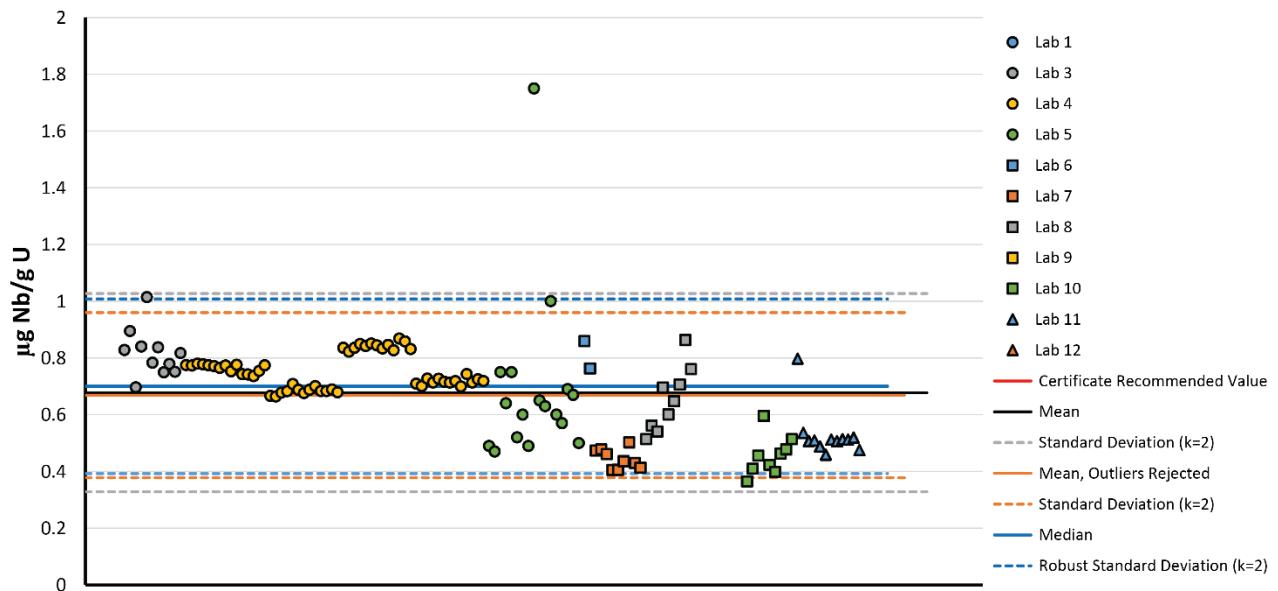
Lab #	Sample #	[Zr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Zr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Zr] ( $\mu\text{g/gU}$ )
1	1	500	4	34	568.181	7	8	475.5019
1	2	550	4	35	563.219	7	9	454.4799
1	3	500	4	36	561.781	8	1	600
3	1	578.6	4	37	561.837	8	2	616
3	2	623.8	4	38	560.187	8	3	587
3	3	613.3	4	39	574.166	8	4	655
3	4	630.3	4	40	560.853	8	5	609
3	5	603.0	4	41	555.240	8	6	643
3	6	612.0	4	42	554.155	8	7	574
3	7	591.5	4	43	559.577	8	8	660
3	8	579.3	4	44	562.118	8	9	654
3	9	585.8	4	45	570.407	9	1	
3	10	586.2	4	46	566.595	9	2	
3	11	588.0	4	47	556.496	9	3	
4	1	608.961	4	48	560.464	9	4	
4	2	610.773	4	49	559.390	9	5	
4	3	620.742	4	50	556.437	9	6	
4	4	612.874	4	51	562.435	9	7	
4	5	616.300	4	52	556.491	9	8	
4	6	607.244	4	53	560.216	9	9	
4	7	599.551	4	54	555.910	10	1	570.54
4	8	600.874	5	1	470	10	2	549.57
4	9	597.673	5	2	470	10	3	562.43
4	10	599.554	5	3	550	10	4	555.39
4	11	593.296	5	4	530	10	5	549.24
4	12	595.598	5	5	540	10	6	540.27
4	13	599.527	5	6	520	10	7	569.12
4	14	608.033	5	7	530	10	8	557.76
4	15	612.667	5	8	550	10	9	555.44
4	16	541.101	5	9	560	11	1	528.53
4	17	551.686	5	10	560	11	2	549.78
4	18	563.739	5	11	550	11	3	537.72
4	19	552.259	5	12	550	11	4	531.10
4	20	563.264	5	13	498	11	5	520.17
4	21	561.823	5	14	570	11	6	508.40
4	22	563.724	5	15	560	11	7	525.61
4	23	564.701	5	16	620	11	8	510.36
4	24	561.478	5	17	520	11	9	518.52
4	25	555.650	6	1	548.4385	11	10	529.61
4	26	561.856	6	2	548.9046	11	11	538.17
4	27	561.597	7	1	439.5557	11	12	501.30
4	28	551.329	7	2	468.2028	12	1	534
4	29	564.895	7	3	464.5091	12	2	554
4	30	553.749	7	4	477.0333	12	3	
4	31	560.513	7	5	460.4626	12	4	
4	32	569.576	7	6	466.7216			
4	33	570.225	7	7	480.0421			



**Figure A29.** All Zr concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A30** All data reported for CUP-2 Nb concentration. Data precision as laboratory reported.

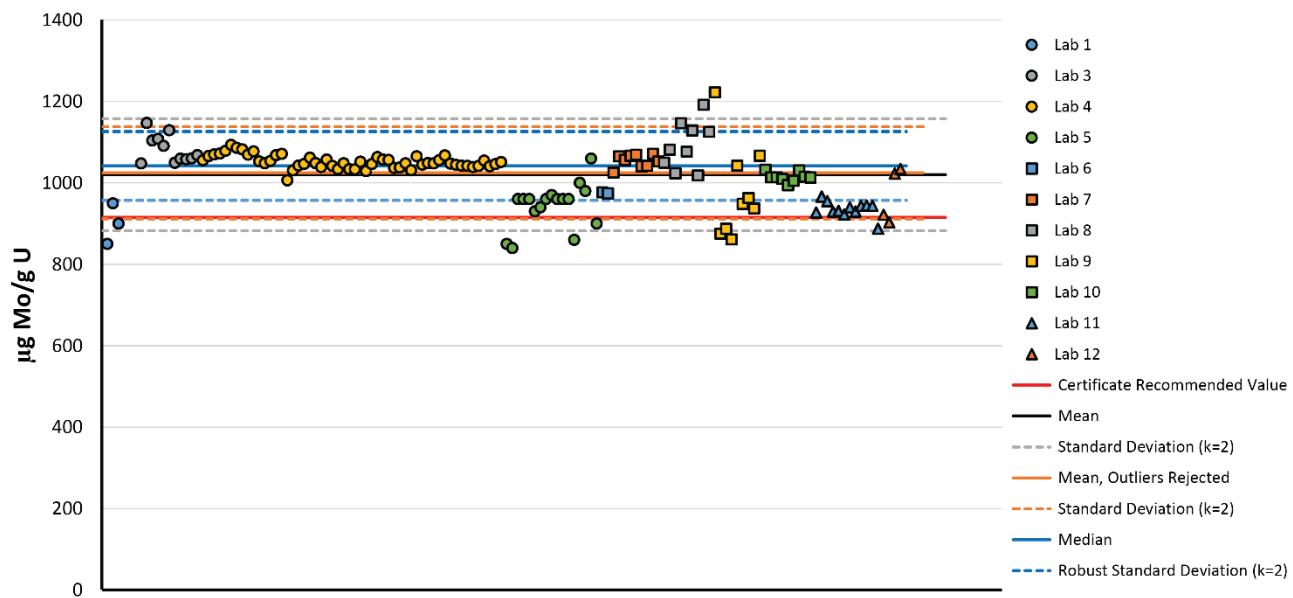
Lab #	Sample #	[Nb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Nb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Nb] ( $\mu\text{g/gU}$ )
1	1		4	34	0.851	7	8	0.4295
1	2		4	35	0.844	7	9	0.4131
1	3		4	36	0.833	8	1	0.514
3	1	0.8	4	37	0.846	8	2	0.562
3	2	0.9	4	38	0.827	8	3	0.540
3	3	0.7	4	39	0.868	8	4	0.695
3	4	0.8	4	40	0.858	8	5	0.601
3	5	1.0	4	41	0.831	8	6	0.648
3	6	0.8	4	42	0.709	8	7	0.706
3	7	0.8	4	43	0.700	8	8	0.863
3	8	0.7	4	44	0.727	8	9	0.760
3	9	0.8	4	45	0.714	9	1	
3	10	0.8	4	46	0.726	9	2	
3	11	0.8	4	47	0.716	9	3	
4	1	0.774	4	48	0.713	9	4	
4	2	0.773	4	49	0.718	9	5	
4	3	0.780	4	50	0.699	9	6	
4	4	0.777	4	51	0.743	9	7	
4	5	0.774	4	52	0.714	9	8	
4	6	0.771	4	53	0.725	9	9	
4	7	0.764	4	54	0.719	10	1	0.37
4	8	0.773	5	1	0.49	10	2	0.41
4	9	0.753	5	2	0.47	10	3	0.46
4	10	0.776	5	3	0.75	10	4	0.60
4	11	0.742	5	4	0.64	10	5	0.42
4	12	0.742	5	5	0.75	10	6	0.40
4	13	0.736	5	6	0.52	10	7	0.46
4	14	0.754	5	7	0.60	10	8	0.48
4	15	0.774	5	8	0.49	10	9	0.51
4	16	0.666	5	9	1.75	11	1	0.80
4	17	0.664	5	10	0.65	11	2	0.54
4	18	0.678	5	11	0.63	11	3	0.51
4	19	0.683	5	12	1.00	11	4	0.51
4	20	0.708	5	13	0.60	11	5	0.49
4	21	0.688	5	14	0.57	11	6	0.46
4	22	0.676	5	15	0.69	11	7	0.51
4	23	0.688	5	16	0.67	11	8	0.51
4	24	0.701	5	17	0.50	11	9	0.51
4	25	0.683	6	1	0.858918	11	10	0.51
4	26	0.683	6	2	0.762691	11	11	0.52
4	27	0.689	7	1	0.4731	11	12	0.47
4	28	0.679	7	2	0.4778	12	1	
4	29	0.835	7	3	0.4607	12	2	
4	30	0.822	7	4	0.4048	12	3	
4	31	0.836	7	5	0.4054	12	4	
4	32	0.849	7	6	0.4359			
4	33	0.841	7	7	0.5022			



**Figure A30.** All Nb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A31** All data reported for CUP-2 Mo concentration. Data precision as laboratory reported.

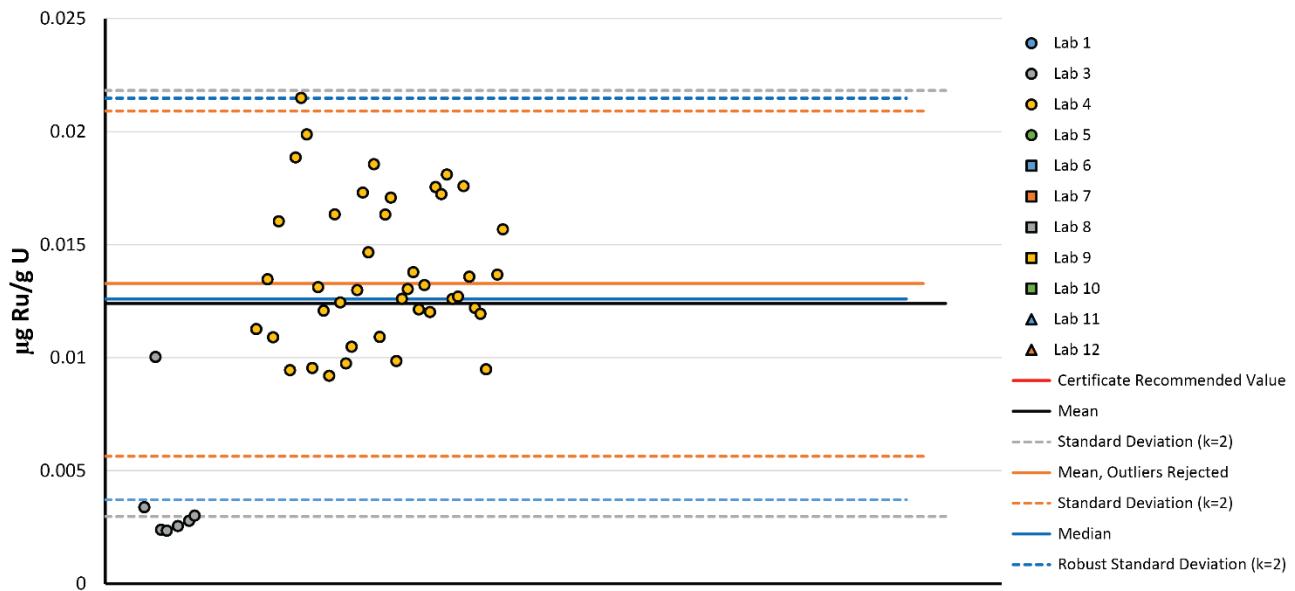
Lab #	Sample #	[Mo] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mo] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Mo] ( $\mu\text{g/gU}$ )
1	1	850	4	34	1056.409	7	8	1071.2785
1	2	950	4	35	1036.442	7	9	1052.5033
1	3	900	4	36	1037.681	8	1	1050
3	1	1047.9	4	37	1048.092	8	2	1080
3	2	1147.1	4	38	1030.969	8	3	1020
3	3	1104.0	4	39	1065.484	8	4	1150
3	4	1108.1	4	40	1044.950	8	5	1080
3	5	1090.7	4	41	1048.467	8	6	1130
3	6	1129.3	4	42	1047.809	8	7	1020
3	7	1049.3	4	43	1056.017	8	8	1190
3	8	1059.5	4	44	1067.571	8	9	1130
3	9	1058.0	4	45	1047.142	9	1	1222.314
3	10	1060.0	4	46	1044.286	9	2	874.996
3	11	1068.0	4	47	1042.079	9	3	887.152
4	1	1055.418	4	48	1041.603	9	4	861.016
4	2	1065.836	4	49	1038.815	9	5	1042.254
4	3	1069.714	4	50	1041.821	9	6	948.122
4	4	1071.935	4	51	1054.819	9	7	962.731
4	5	1078.675	4	52	1040.958	9	8	936.961
4	6	1093.317	4	53	1046.240	9	9	1066.212
4	7	1085.815	4	54	1051.262	10	1	1032.47
4	8	1081.957	5	1	850	10	2	1013.25
4	9	1069.354	5	2	840	10	3	1013.35
4	10	1077.499	5	3	960	10	4	1009.34
4	11	1052.908	5	4	960	10	5	993.99
4	12	1048.234	5	5	960	10	6	1004.65
4	13	1053.959	5	6	930	10	7	1030.62
4	14	1067.753	5	7	940	10	8	1015.02
4	15	1071.462	5	8	960	10	9	1013.00
4	16	1006.409	5	9	970	11	1	927.35
4	17	1030.482	5	10	960	11	2	966.16
4	18	1042.686	5	11	960	11	3	954.87
4	19	1046.596	5	12	960	11	4	929.14
4	20	1061.892	5	13	860	11	5	931.37
4	21	1048.567	5	14	1000	11	6	922.75
4	22	1038.783	5	15	980	11	7	939.44
4	23	1057.108	5	16	1060	11	8	929.69
4	24	1041.545	5	17	900	11	9	944.02
4	25	1033.765	6	1	976.6703	11	10	944.53
4	26	1048.315	6	2	973.7589	11	11	943.91
4	27	1033.627	7	1	1025.5486	11	12	887.32
4	28	1033.188	7	2	1064.9090	12	1	922
4	29	1052.189	7	3	1056.0569	12	2	903
4	30	1028.999	7	4	1066.0636	12	3	1023
4	31	1045.886	7	5	1068.6465	12	4	1034
4	32	1063.122	7	6	1040.4025			
4	33	1057.432	7	7	1041.6276			



**Figure A31.** All Mo concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A32** All data reported for CUP-2 Ru concentration. Data precision as laboratory reported.

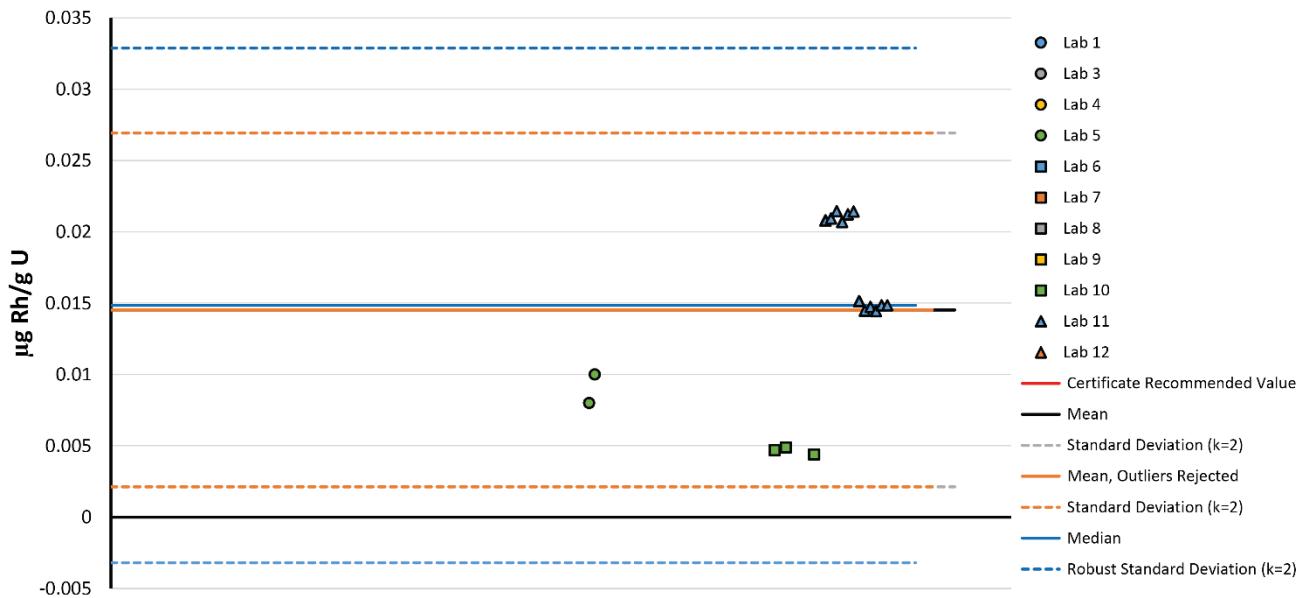
Lab #	Sample #	[Ru] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ru] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ru] ( $\mu\text{g/gU}$ )
1	1		4	34	0.017	7	8	
1	2		4	35	0.010	7	9	
1	3		4	36	0.013	8	1	
3	1	0.003	4	37	0.013	8	2	
3	2		4	38	0.014	8	3	
3	3	0.010	4	39	0.012	8	4	
3	4	0.002	4	40	0.013	8	5	
3	5	0.002	4	41	0.012	8	6	
3	6		4	42	0.018	8	7	
3	7	0.003	4	43	0.017	8	8	
3	8		4	44	0.018	8	9	
3	9	0.003	4	45	0.013	9	1	
3	10	0.003	4	46	0.013	9	2	
3	11		4	47	0.018	9	3	
4	1		4	48	0.014	9	4	
4	2		4	49	0.012	9	5	
4	3		4	50	0.012	9	6	
4	4		4	51	0.009	9	7	
4	5		4	52		9	8	
4	6		4	53	0.014	9	9	
4	7		4	54	0.016	10	1	
4	8		5	1		10	2	
4	9		5	2		10	3	
4	10	0.011	5	3		10	4	
4	11		5	4		10	5	
4	12	0.013	5	5		10	6	
4	13	0.011	5	6		10	7	
4	14	0.016	5	7		10	8	
4	15		5	8		10	9	
4	16	0.009	5	9		11	1	
4	17	0.019	5	10		11	2	
4	18	0.021	5	11		11	3	
4	19	0.020	5	12		11	4	
4	20	0.010	5	13		11	5	
4	21	0.013	5	14		11	6	
4	22	0.012	5	15		11	7	
4	23	0.009	5	16		11	8	
4	24	0.016	5	17		11	9	
4	25	0.012	6	1		11	10	
4	26	0.010	6	2		11	11	
4	27	0.010	7	1		11	12	
4	28	0.013	7	2		12	1	
4	29	0.017	7	3		12	2	
4	30	0.015	7	4		12	3	
4	31	0.019	7	5		12	4	
4	32	0.011	7	6				
4	33	0.016	7	7				



**Figure A32.** All Ru concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A33** All data reported for CUP-2 Rh concentration. Data precision as laboratory reported.

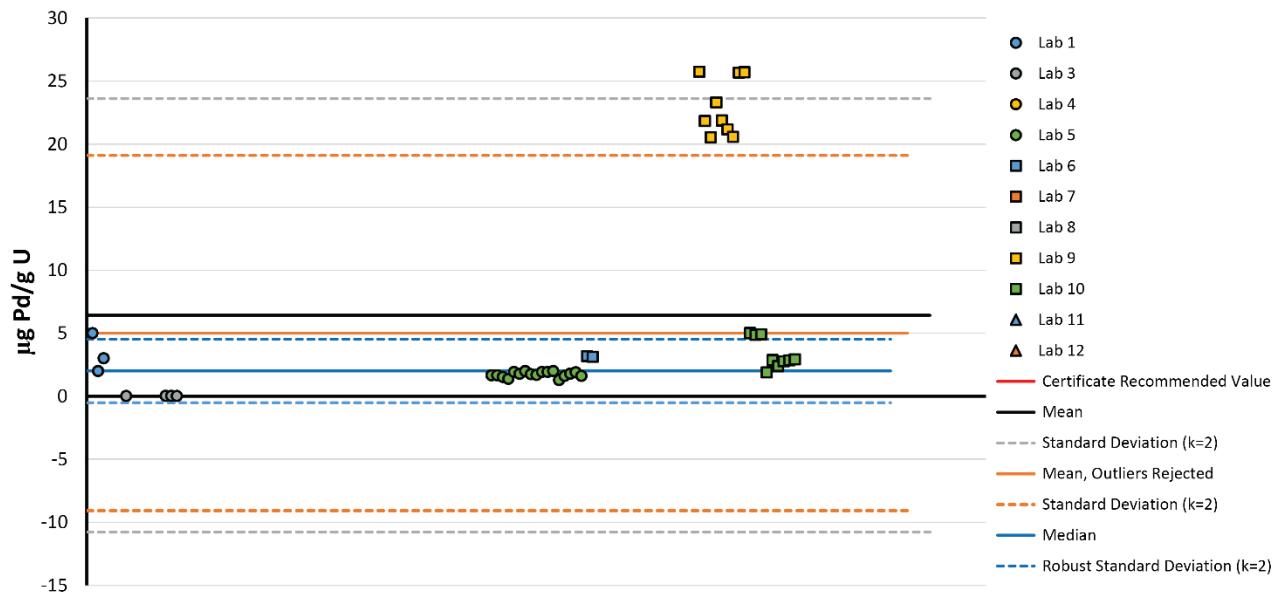
Lab #	Sample #	[Rh] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Rh] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Rh] ( $\mu\text{g/gU}$ )
1	1		4	34		7	8	
1	2		4	35		7	9	
1	3		4	36		8	1	
3	1		4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	
3	10		4	46		9	2	
3	11		4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	0.005
4	8		5	1		10	2	
4	9		5	2		10	3	0.005
4	10		5	3		10	4	
4	11		5	4		10	5	
4	12		5	5		10	6	
4	13		5	6		10	7	
4	14		5	7		10	8	0.004
4	15		5	8		10	9	
4	16		5	9		11	1	0.02
4	17		5	10		11	2	0.02
4	18		5	11		11	3	0.02
4	19		5	12		11	4	0.02
4	20		5	13		11	5	0.02
4	21		5	14	0.008	11	6	0.02
4	22		5	15	0.010	11	7	0.02
4	23		5	16		11	8	0.01
4	24		5	17		11	9	0.01
4	25		6	1		11	10	0.01
4	26		6	2		11	11	0.01
4	27		7	1		11	12	0.01
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A33.** All Rh concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A34** All data reported for CUP-2 Pd concentration. Data precision as laboratory reported.

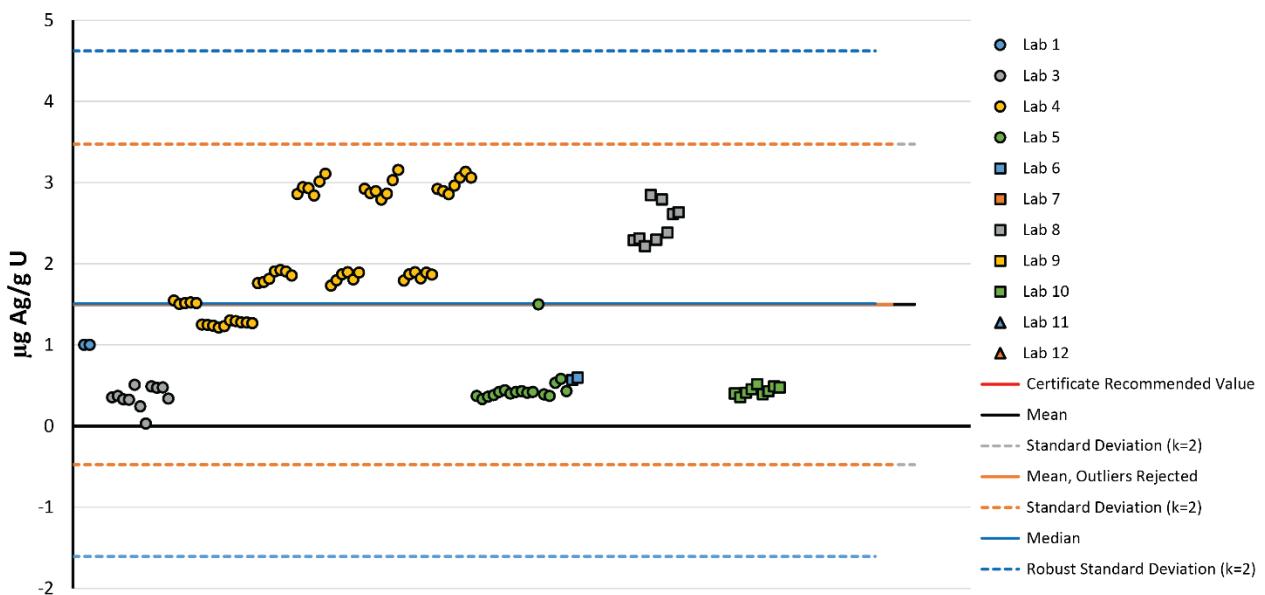
Lab #	Sample #	[Pd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pd] ( $\mu\text{g/gU}$ )
1	1	5	4	34		7	8	
1	2	2	4	35		7	9	
1	3	3	4	36		8	1	
3	1	0.01	4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8	0.03	4	44		8	9	
3	9	0.02	4	45		9	1	25.737
3	10	0.02	4	46		9	2	21.827
3	11		4	47		9	3	20.523
4	1		4	48		9	4	23.295
4	2		4	49		9	5	21.872
4	3		4	50		9	6	21.168
4	4		4	51		9	7	20.569
4	5		4	52		9	8	25.665
4	6		4	53		9	9	25.690
4	7		4	54		10	1	5.00
4	8		5	1	1.66	10	2	4.86
4	9		5	2	1.66	10	3	4.90
4	10		5	3	1.52	10	4	1.88
4	11		5	4	1.37	10	5	2.85
4	12		5	5	1.93	10	6	2.39
4	13		5	6	1.77	10	7	2.77
4	14		5	7	2.00	10	8	2.83
4	15		5	8	1.75	10	9	2.92
4	16		5	9	1.69	11	1	
4	17		5	10	1.93	11	2	
4	18		5	11	1.92	11	3	
4	19		5	12	2.00	11	4	
4	20		5	13	1.27	11	5	
4	21		5	14	1.60	11	6	
4	22		5	15	1.78	11	7	
4	23		5	16	1.90	11	8	
4	24		5	17	1.60	11	9	
4	25		6	1	3.173085	11	10	
4	26		6	2	3.120612	11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A34.** All Pd concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A35** All data reported for CUP-2 Ag concentration. Data precision as laboratory reported.

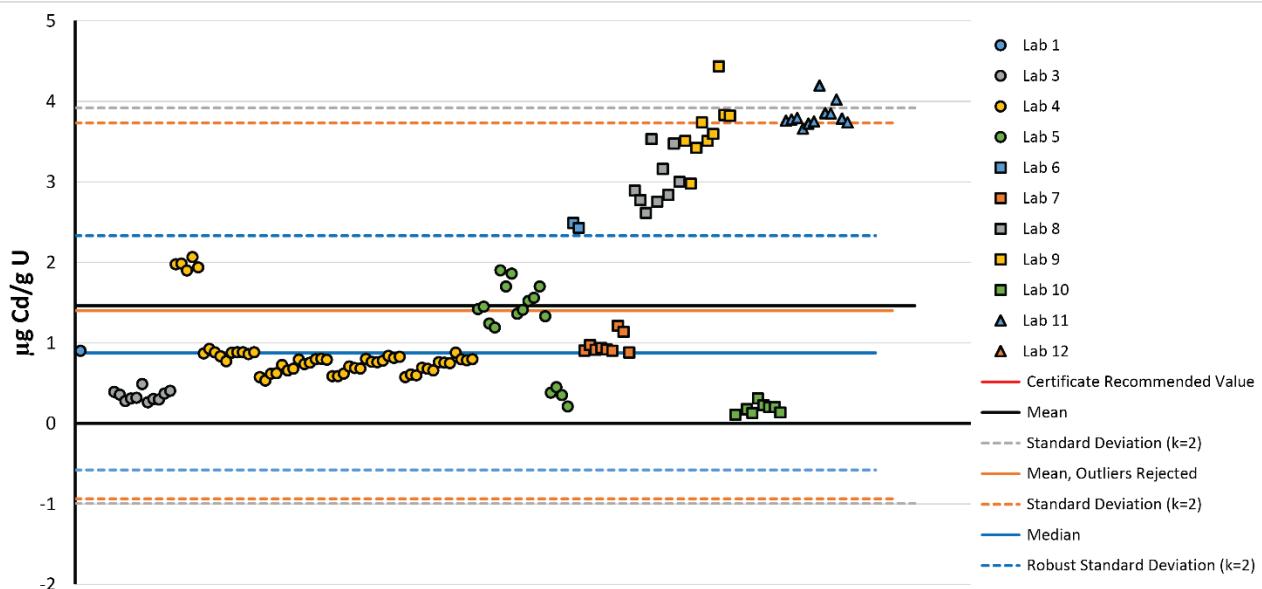
Lab #	Sample #	[Ag] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ag] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ag] ( $\mu\text{g/gU}$ )
1	1		4	34	1.891	7	8	
1	2	1	4	35	2.923	7	9	
1	3	1	4	36	2.868	8	1	2.29
3	1	0.4	4	37	2.893	8	2	2.31
3	2	0.4	4	38	2.789	8	3	2.22
3	3	0.3	4	39	2.862	8	4	2.85
3	4	0.3	4	40	3.028	8	5	2.29
3	5	0.5	4	41	3.155	8	6	2.79
3	6	0.2	4	42	1.791	8	7	2.38
3	7	0.03	4	43	1.868	8	8	2.61
3	8	0.5	4	44	1.896	8	9	2.63
3	9	0.5	4	45	1.819	9	1	
3	10	0.5	4	46	1.888	9	2	
3	11	0.3	4	47	1.865	9	3	
4	1	1.547	4	48	2.921	9	4	
4	2	1.503	4	49	2.895	9	5	
4	3	1.514	4	50	2.857	9	6	
4	4	1.522	4	51	2.963	9	7	
4	5	1.515	4	52	3.061	9	8	
4	6	1.250	4	53	3.132	9	9	
4	7	1.246	4	54	3.061	10	1	0.40
4	8	1.235	5	1	0.37	10	2	0.36
4	9	1.212	5	2	0.33	10	3	0.41
4	10	1.230	5	3	0.36	10	4	0.45
4	11	1.300	5	4	0.38	10	5	0.51
4	12	1.291	5	5	0.42	10	6	0.39
4	13	1.278	5	6	0.44	10	7	0.43
4	14	1.276	5	7	0.40	10	8	0.49
4	15	1.266	5	8	0.42	10	9	0.48
4	16	1.759	5	9	0.43	11	1	
4	17	1.775	5	10	0.41	11	2	
4	18	1.812	5	11	0.42	11	3	
4	19	1.906	5	12	1.50	11	4	
4	20	1.920	5	13	0.39	11	5	
4	21	1.903	5	14	0.37	11	6	
4	22	1.854	5	15	0.53	11	7	
4	23	2.859	5	16	0.58	11	8	
4	24	2.942	5	17	0.43	11	9	
4	25	2.930	6	1	0.565293	11	10	
4	26	2.840	6	2	0.595186	11	11	
4	27	3.014	7	1		11	12	
4	28	3.107	7	2		12	1	
4	29	1.728	7	3		12	2	
4	30	1.797	7	4		12	3	
4	31	1.870	7	5		12	4	
4	32	1.896	7	6				
4	33	1.803	7	7				



**Figure A35.** All Ag concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A36** All data reported for CUP-2 Cd concentration. Data precision as laboratory reported.

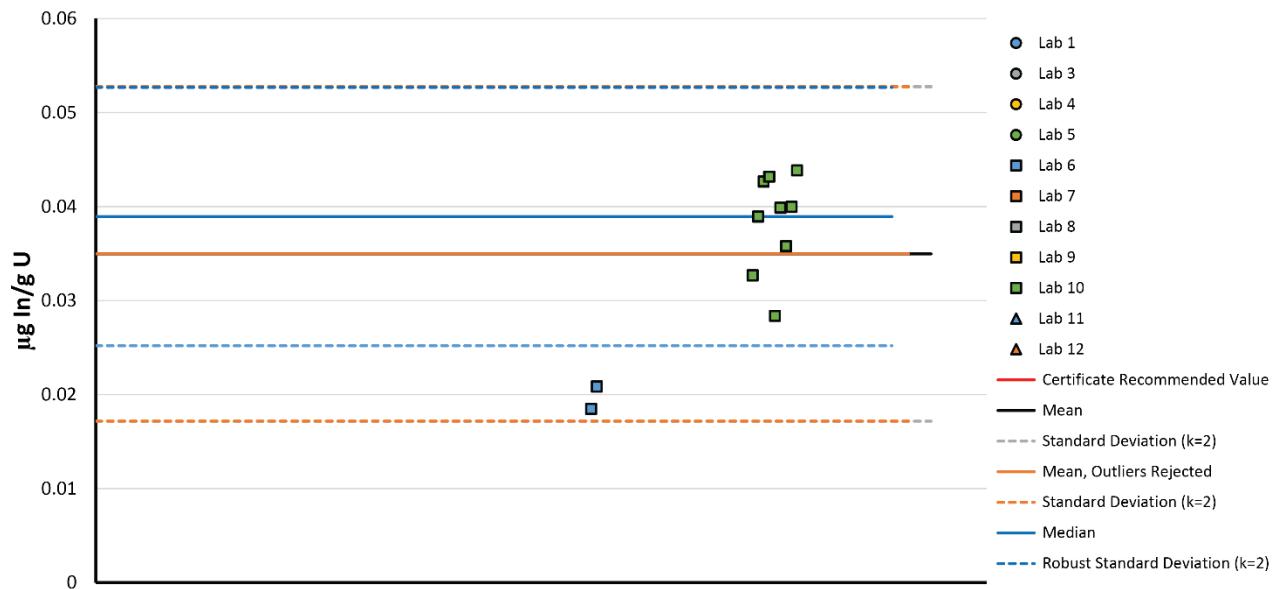
Lab #	Sample #	[Cd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cd] ( $\mu\text{g/gU}$ )
1	1	1	4	34	0.681	7	8	1.1357
1	2		4	35	0.802	7	9	0.8786
1	3		4	36	0.765	8	1	2.89
3	1	0.4	4	37	0.760	8	2	2.77
3	2	0.4	4	38	0.778	8	3	2.61
3	3	0.3	4	39	0.838	8	4	3.53
3	4	0.3	4	40	0.812	8	5	2.75
3	5	0.3	4	41	0.827	8	6	3.16
3	6	0.5	4	42	0.575	8	7	2.84
3	7	0.3	4	43	0.608	8	8	3.47
3	8	0.3	4	44	0.598	8	9	3.00
3	9	0.3	4	45	0.692	9	1	3.505
3	10	0.4	4	46	0.676	9	2	2.978
3	11	0.4	4	47	0.658	9	3	3.419
4	1	1.975	4	48	0.760	9	4	3.737
4	2	1.984	4	49	0.754	9	5	3.506
4	3	1.898	4	50	0.747	9	6	3.592
4	4	2.065	4	51	0.879	9	7	4.433
4	5	1.937	4	52	0.795	9	8	3.829
4	6	0.869	4	53	0.785	9	9	3.820
4	7	0.924	4	54	0.798	10	1	0.11
4	8	0.882	5	1	1.42	10	2	
4	9	0.835	5	2	1.45	10	3	0.18
4	10	0.771	5	3	1.24	10	4	0.13
4	11	0.876	5	4	1.19	10	5	0.31
4	12	0.884	5	5	1.90	10	6	0.22
4	13	0.883	5	6	1.70	10	7	0.20
4	14	0.859	5	7	1.86	10	8	0.20
4	15	0.884	5	8	1.36	10	9	0.13
4	16	0.576	5	9	1.41	11	1	3.76
4	17	0.531	5	10	1.52	11	2	3.77
4	18	0.616	5	11	1.56	11	3	3.79
4	19	0.623	5	12	1.70	11	4	3.66
4	20	0.727	5	13	1.33	11	5	3.72
4	21	0.656	5	14	0.38	11	6	3.75
4	22	0.678	5	15	0.45	11	7	4.19
4	23	0.793	5	16	0.35	11	8	3.85
4	24	0.736	5	17	0.21	11	9	3.85
4	25	0.753	6	1	2.487912	11	10	4.02
4	26	0.798	6	2	2.427057	11	11	3.78
4	27	0.804	7	1	0.9034	11	12	3.74
4	28	0.791	7	2	0.9718	12	1	
4	29	0.587	7	3	0.9145	12	2	
4	30	0.587	7	4	0.9353	12	3	
4	31	0.618	7	5	0.9167	12	4	
4	32	0.706	7	6	0.9010			
4	33	0.688	7	7	1.2123			



**Figure A36.** All Cd concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A37** All data reported for CUP-2 In concentration. Data precision as laboratory reported.

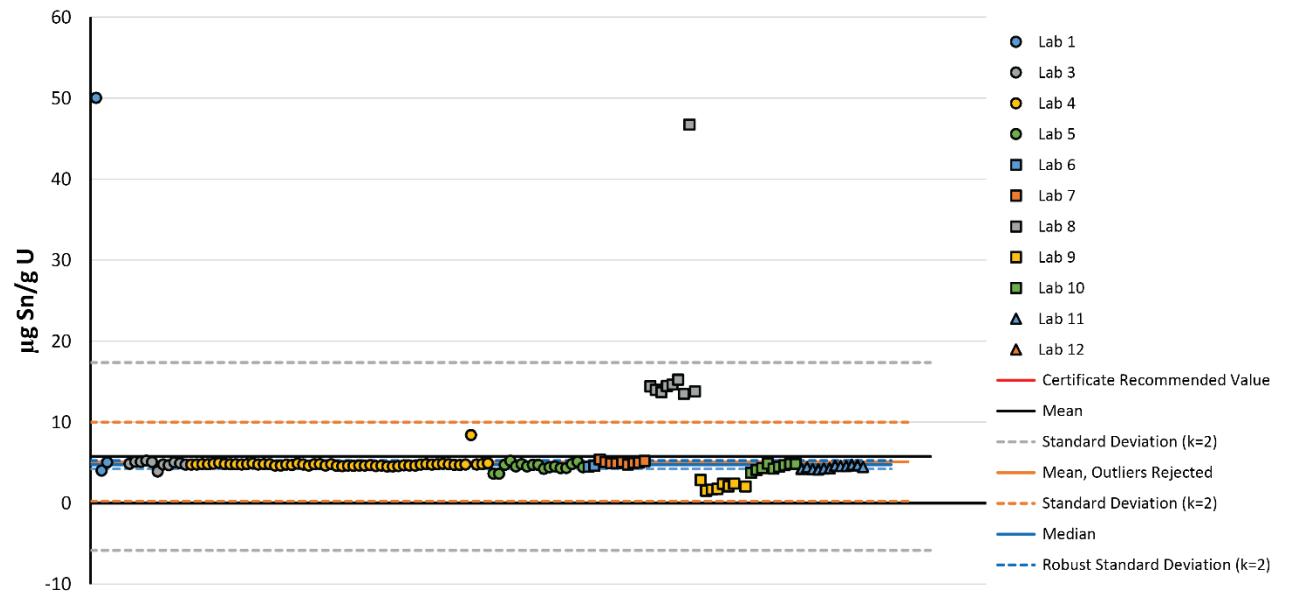
Lab #	Sample #	[In] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[In] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[In] ( $\mu\text{g/gU}$ )
1	1		4	34		7	8	
1	2		4	35		7	9	
1	3		4	36		8	1	
3	1		4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	
3	10		4	46		9	2	
3	11		4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	0.03
4	8		5	1		10	2	0.04
4	9		5	2		10	3	0.04
4	10		5	3		10	4	0.04
4	11		5	4		10	5	0.03
4	12		5	5		10	6	0.04
4	13		5	6		10	7	0.04
4	14		5	7		10	8	0.04
4	15		5	8		10	9	0.04
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1	0.018484	11	10	
4	26		6	2	0.020855	11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A37.** All In concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A38** All data reported for CUP-2 Sn concentration. Data precision as laboratory reported.

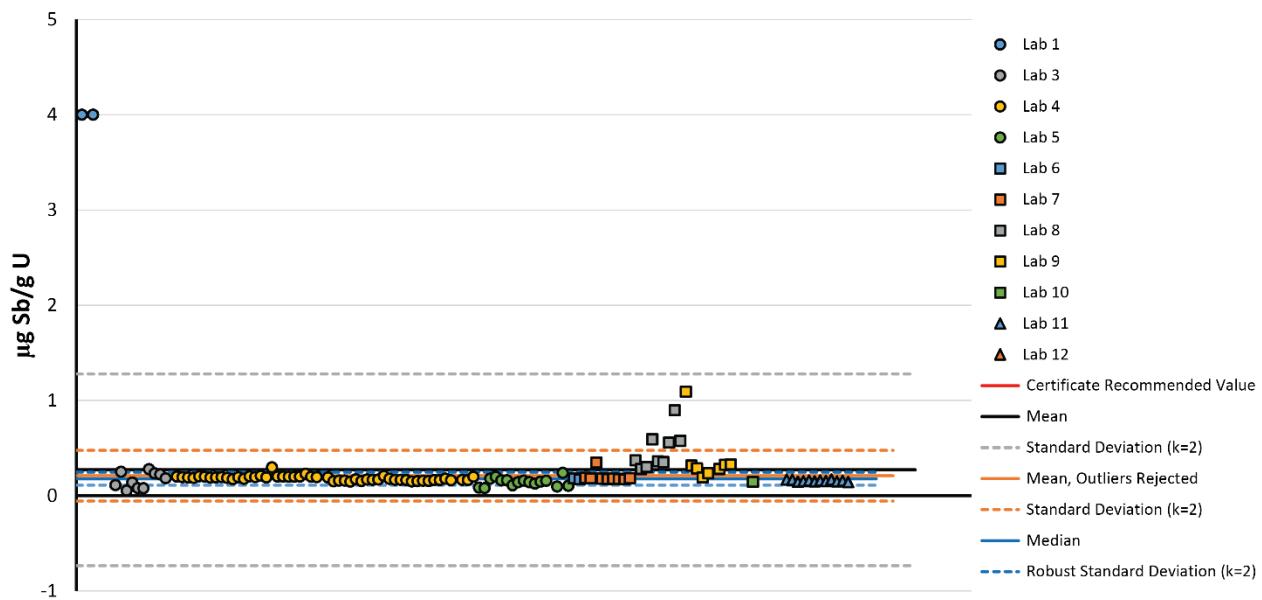
Lab #	Sample #	[Sn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sn] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sn] ( $\mu\text{g/gU}$ )
1	1	50	4	34	4.553	7	8	4.9709
1	2	4	4	35	4.590	7	9	5.1828
1	3	5	4	36	4.486	8	1	14.4
3	1	4.8	4	37	4.512	8	2	14.0
3	2	5.1	4	38	4.552	8	3	13.7
3	3	5.1	4	39	4.641	8	4	14.4
3	4	5.2	4	40	4.611	8	5	14.6
3	5	5.0	4	41	4.585	8	6	15.2
3	6	3.9	4	42	4.726	8	7	13.5
3	7	4.7	4	43	4.784	8	8	46.7
3	8	4.7	4	44	4.722	8	9	13.8
3	9	5.0	4	45	4.770	9	1	2.835
3	10	4.9	4	46	4.829	9	2	1.506
3	11	4.7	4	47	4.768	9	3	1.642
4	1	4.732	4	48	4.698	9	4	1.725
4	2	4.741	4	49	4.686	9	5	2.353
4	3	4.779	4	50	4.736	9	6	2.055
4	4	4.774	4	51	8.380	9	7	2.380
4	5	4.853	4	52	4.740	9	8	
4	6	4.944	4	53	4.789	9	9	2.026
4	7	4.803	4	54	4.900	10	1	3.72
4	8	4.760	5	1	3.60	10	2	4.07
4	9	4.765	5	2	3.60	10	3	4.30
4	10	4.755	5	3	4.70	10	4	4.86
4	11	4.784	5	4	5.20	10	5	4.23
4	12	4.868	5	5	4.50	10	6	4.47
4	13	4.748	5	6	4.80	10	7	4.66
4	14	4.799	5	7	4.50	10	8	4.80
4	15	4.770	5	8	4.70	10	9	4.80
4	16	4.606	5	9	4.70	11	1	4.22
4	17	4.608	5	10	4.20	11	2	4.39
4	18	4.718	5	11	4.40	11	3	4.16
4	19	4.681	5	12	4.50	11	4	4.12
4	20	4.851	5	13	4.30	11	5	4.25
4	21	4.742	5	14	4.32	11	6	4.28
4	22	4.606	5	15	4.80	11	7	4.61
4	23	4.763	5	16	5.10	11	8	4.55
4	24	4.792	5	17	4.40	11	9	4.58
4	25	4.624	6	1	4.470691	11	10	4.71
4	26	4.773	6	2	4.567438	11	11	4.66
4	27	4.584	7	1	5.3434	11	12	4.45
4	28	4.534	7	2	5.0544	12	1	
4	29	4.590	7	3	4.8999	12	2	
4	30	4.581	7	4	4.8878	12	3	
4	31	4.615	7	5	5.0405	12	4	
4	32	4.595	7	6	4.7409			
4	33	4.667	7	7	4.9144			



**Figure A38.** All Sn concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A39** All data reported for CUP-2 Sb concentration. Data precision as laboratory reported.

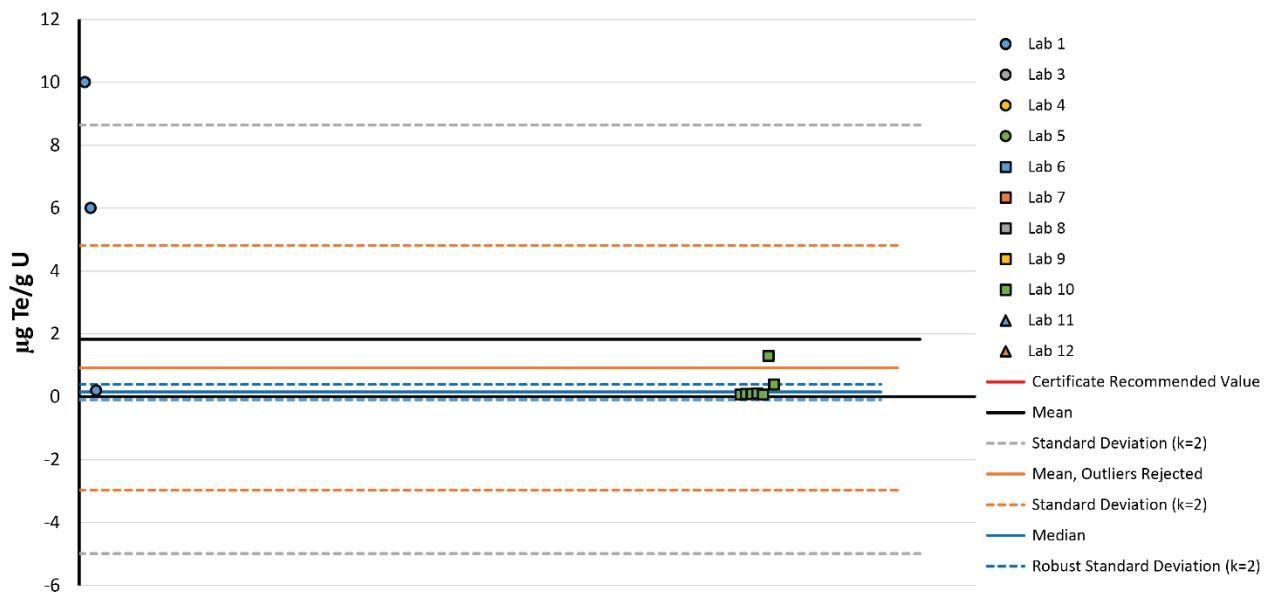
Lab #	Sample #	[Sb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sb] ( $\mu\text{g/gU}$ )
1	1	4	4	34	0.153	7	8	0.1709
1	2		4	35	0.170	7	9	0.1819
1	3	4	4	36	0.166	8	1	0.370
3	1	0.1	4	37	0.170	8	2	0.280
3	2	0.3	4	38	0.207	8	3	0.301
3	3	0.1	4	39	0.177	8	4	0.591
3	4	0.1	4	40	0.166	8	5	0.362
3	5	0.1	4	41	0.167	8	6	0.351
3	6	0.1	4	42	0.164	8	7	0.557
3	7	0.3	4	43	0.149	8	8	0.896
3	8	0.2	4	44	0.153	8	9	0.574
3	9	0.2	4	45	0.156	9	1	1.091
3	10	0.2	4	46	0.155	9	2	0.315
3	11		4	47	0.164	9	3	0.286
4	1	0.201	4	48	0.164	9	4	0.192
4	2	0.194	4	49	0.178	9	5	0.235
4	3	0.191	4	50	0.161	9	6	
4	4	0.186	4	51		9	7	0.279
4	5	0.203	4	52	0.166	9	8	0.324
4	6	0.199	4	53	0.165	9	9	0.327
4	7	0.190	4	54	0.199	10	1	
4	8	0.192	5	1	0.09	10	2	
4	9	0.194	5	2	0.08	10	3	
4	10	0.186	5	3	0.18	10	4	0.14
4	11	0.172	5	4	0.20	10	5	
4	12	0.194	5	5	0.16	10	6	
4	13	0.177	5	6	0.16	10	7	
4	14	0.203	5	7	0.11	10	8	
4	15	0.195	5	8	0.14	10	9	
4	16	0.208	5	9	0.16	11	1	0.17
4	17	0.191	5	10	0.14	11	2	0.17
4	18	0.296	5	11	0.13	11	3	0.15
4	19	0.200	5	12	0.15	11	4	0.15
4	20	0.201	5	13	0.16	11	5	0.16
4	21	0.198	5	14		11	6	0.15
4	22	0.199	5	15	0.10	11	7	0.16
4	23	0.201	5	16	0.24	11	8	0.16
4	24	0.230	5	17	0.10	11	9	0.17
4	25	0.199	6	1	0.181343	11	10	0.15
4	26	0.196	6	2	0.172083	11	11	0.16
4	27	NAN	7	1	0.1860	11	12	0.14
4	28	0.191	7	2	0.1795	12	1	
4	29	0.151	7	3	0.3468	12	2	
4	30	0.158	7	4	0.1785	12	3	
4	31	0.159	7	5	0.1724	12	4	
4	32	0.148	7	6	0.1789			
4	33	0.172	7	7	0.1752			



**Figure A39.** All Sb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A40** All data reported for CUP-2 Te concentration. Data precision as laboratory reported.

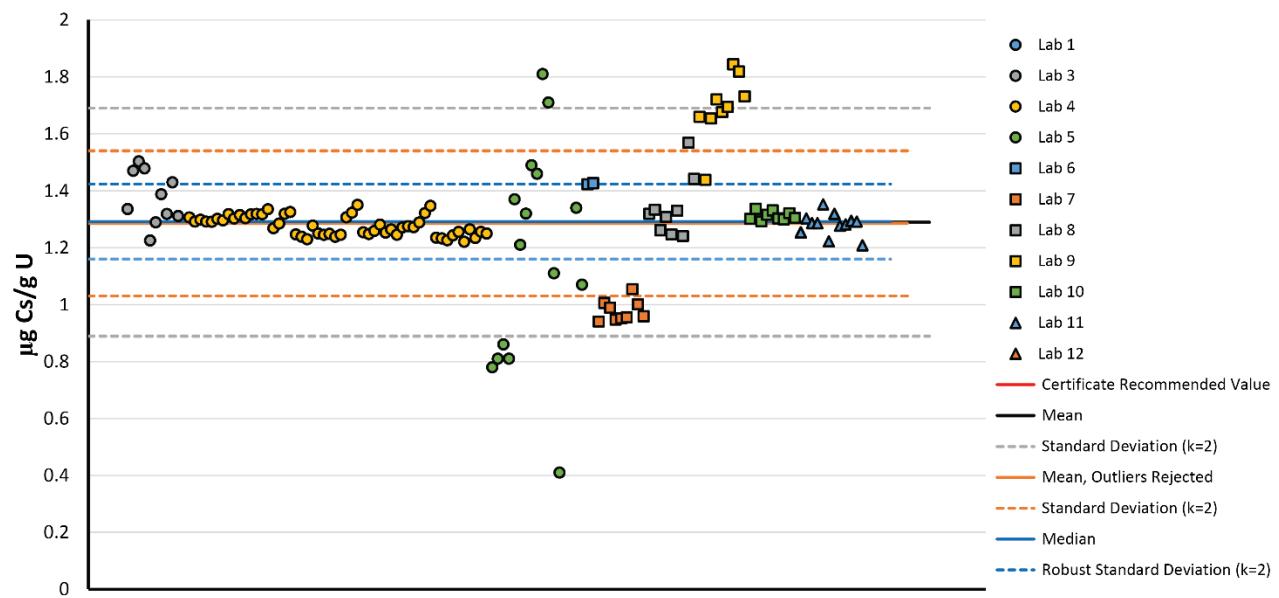
Lab #	Sample #	[Te] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Te] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Te] ( $\mu\text{g/gU}$ )
1	1	10	4	34		7	8	
1	2	6	4	35		7	9	
1	3	0.2	4	36		8	1	
3	1		4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	
3	10		4	46		9	2	
3	11		4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	0.07
4	8		5	1		10	2	0.08
4	9		5	2		10	3	0.08
4	10		5	3		10	4	0.10
4	11		5	4		10	5	0.07
4	12		5	5		10	6	1.29
4	13		5	6		10	7	0.38
4	14		5	7		10	8	
4	15		5	8		10	9	
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21		5	14		11	6	
4	22		5	15		11	7	
4	23		5	16		11	8	
4	24		5	17		11	9	
4	25		6	1		11	10	
4	26		6	2		11	11	
4	27		7	1		11	12	
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A40.** All Te concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A41** All data reported for CUP-2 Cs concentration. Data precision as laboratory reported.

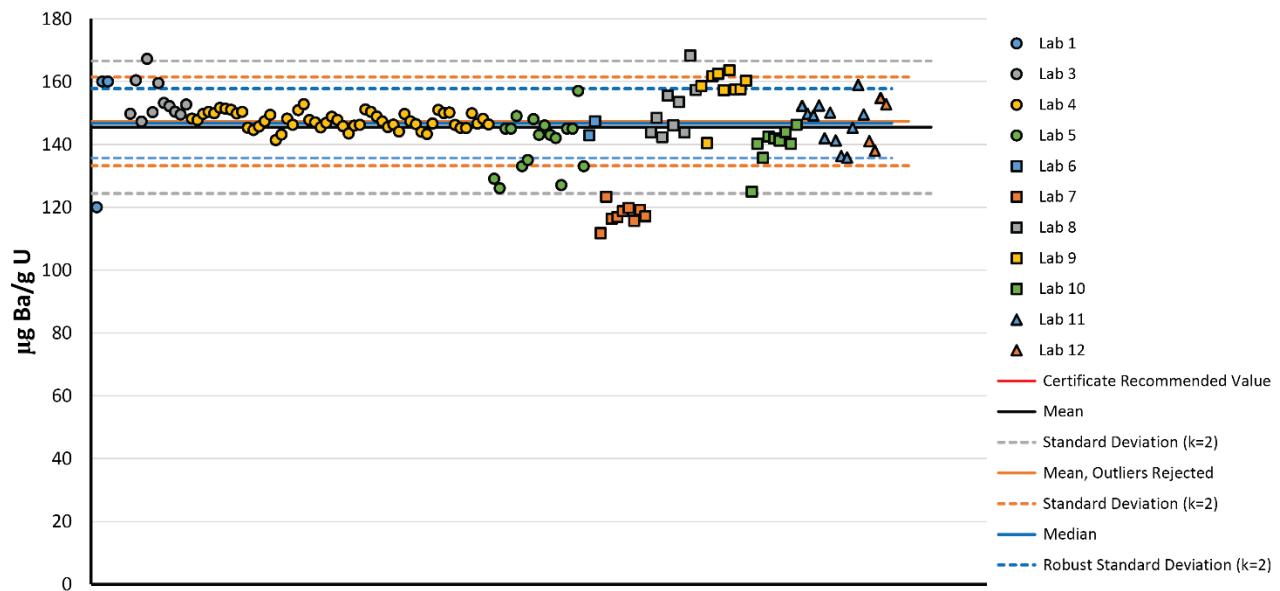
Lab #	Sample #	[Cs] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cs] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Cs] ( $\mu\text{g/gU}$ )
1	1		4	34	1.259	7	8	1.0005
1	2		4	35	1.281	7	9	0.9592
1	3		4	36	1.253	8	1	1.32
3	1	1.3	4	37	1.264	8	2	1.33
3	2	1.5	4	38	1.246	8	3	1.26
3	3	1.5	4	39	1.271	8	4	1.31
3	4	1.5	4	40	1.275	8	5	1.25
3	5	1.2	4	41	1.272	8	6	1.33
3	6	1.3	4	42	1.288	8	7	1.24
3	7	1.4	4	43	1.321	8	8	1.57
3	8	1.3	4	44	1.347	8	9	1.44
3	9	1.4	4	45	1.235	9	1	1.660
3	10	1.3	4	46	1.233	9	2	1.439
3	11		4	47	1.226	9	3	1.654
4	1	1.306	4	48	1.243	9	4	1.721
4	2	1.292	4	49	1.255	9	5	1.676
4	3	1.299	4	50	1.221	9	6	1.695
4	4	1.291	4	51	1.264	9	7	1.845
4	5	1.291	4	52	1.234	9	8	1.819
4	6	1.302	4	53	1.256	9	9	1.731
4	7	1.296	4	54	1.250	10	1	1.30
4	8	1.318	5	1	0.78	10	2	1.34
4	9	1.303	5	2	0.81	10	3	1.29
4	10	1.315	5	3	0.86	10	4	1.32
4	11	1.304	5	4	0.81	10	5	1.33
4	12	1.317	5	5	1.37	10	6	1.30
4	13	1.319	5	6	1.21	10	7	1.30
4	14	1.317	5	7	1.32	10	8	1.32
4	15	1.335	5	8	1.49	10	9	1.30
4	16	1.268	5	9	1.46	11	1	1.25
4	17	1.285	5	10	1.81	11	2	1.30
4	18	1.320	5	11	1.71	11	3	1.29
4	19	1.325	5	12	1.11	11	4	1.29
4	20	1.247	5	13	0.41	11	5	1.35
4	21	1.239	5	14		11	6	1.22
4	22	1.230	5	15		11	7	1.32
4	23	1.278	5	16	1.34	11	8	1.28
4	24	1.250	5	17	1.07	11	9	1.28
4	25	1.245	6	1	1.423103	11	10	1.29
4	26	1.248	6	2	1.426777	11	11	1.29
4	27	1.238	7	1	0.9409	11	12	1.21
4	28	1.246	7	2	1.0056	12	1	
4	29	1.307	7	3	0.9891	12	2	
4	30	1.323	7	4	0.9475	12	3	
4	31	1.350	7	5	0.9519	12	4	
4	32	1.254	7	6	0.9553			
4	33	1.248	7	7	1.0544			



**Figure A41.** All Cs concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A42** All data reported for CUP-2 Ba concentration. Data precision as laboratory reported.

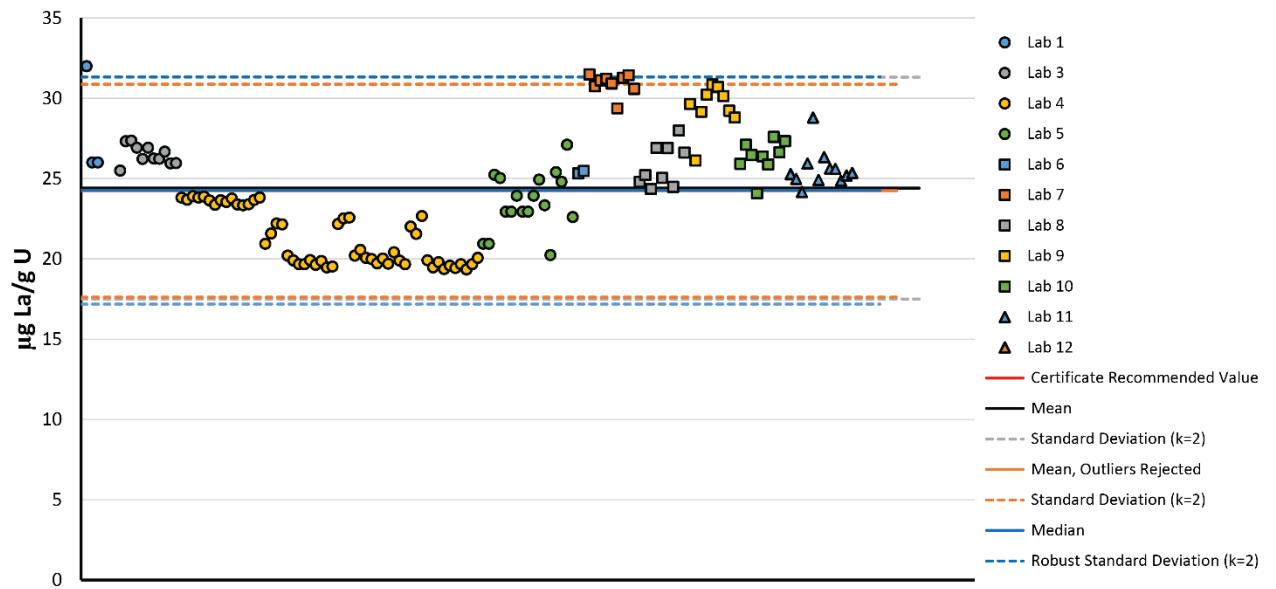
Lab #	Sample #	[Ba] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ba] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ba] ( $\mu\text{g/gU}$ )
1	1	120	4	34	148.839	7	8	119.1609
1	2	160	4	35	147.266	7	9	117.0799
1	3	160	4	36	145.493	8	1	144
3	1	149.7	4	37	146.259	8	2	148
3	2	160.4	4	38	144.064	8	3	142
3	3	147.2	4	39	149.667	8	4	156
3	4	167.2	4	40	147.316	8	5	146
3	5	150.2	4	41	146.474	8	6	154
3	6	159.5	4	42	143.991	8	7	144
3	7	153.2	4	43	143.306	8	8	168
3	8	152.2	4	44	146.619	8	9	157
3	9	150.4	4	45	150.924	9	1	158.546
3	10	149.5	4	46	149.973	9	2	140.424
3	11	152.7	4	47	150.095	9	3	161.693
4	1	148.193	4	48	146.182	9	4	162.448
4	2	147.719	4	49	145.237	9	5	157.236
4	3	149.681	4	50	145.152	9	6	163.604
4	4	150.322	4	51	149.888	9	7	157.433
4	5	149.871	4	52	146.591	9	8	157.514
4	6	151.617	4	53	148.136	9	9	160.284
4	7	151.347	4	54	146.319	10	1	124.94
4	8	151.010	5	1	129	10	2	140.15
4	9	149.838	5	2	126	10	3	135.68
4	10	150.308	5	3	145	10	4	142.45
4	11	145.265	5	4	145	10	5	141.90
4	12	144.578	5	5	149	10	6	141.18
4	13	145.651	5	6	133	10	7	143.89
4	14	147.355	5	7	135	10	8	140.19
4	15	149.406	5	8	148	10	9	146.24
4	16	141.341	5	9	143	11	1	152.28
4	17	143.106	5	10	146	11	2	149.71
4	18	148.176	5	11	143	11	3	149.23
4	19	146.245	5	12	142	11	4	152.38
4	20	150.866	5	13	127	11	5	141.95
4	21	152.778	5	14	145	11	6	150.13
4	22	147.732	5	15	145	11	7	141.23
4	23	147.022	5	16	157	11	8	136.31
4	24	145.423	5	17	133	11	9	135.82
4	25	146.833	6	1	142.8739	11	10	145.29
4	26	148.788	6	2	147.3237	11	11	158.92
4	27	147.804	7	1	111.7261	11	12	149.51
4	28	145.790	7	2	123.2833	12	1	141
4	29	143.446	7	3	116.3071	12	2	138
4	30	145.954	7	4	116.8330	12	3	154.7
4	31	146.227	7	5	118.7382	12	4	152.8
4	32	151.125	7	6	119.7593			
4	33	150.317	7	7	115.6710			



**Figure A42.** All Ba concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

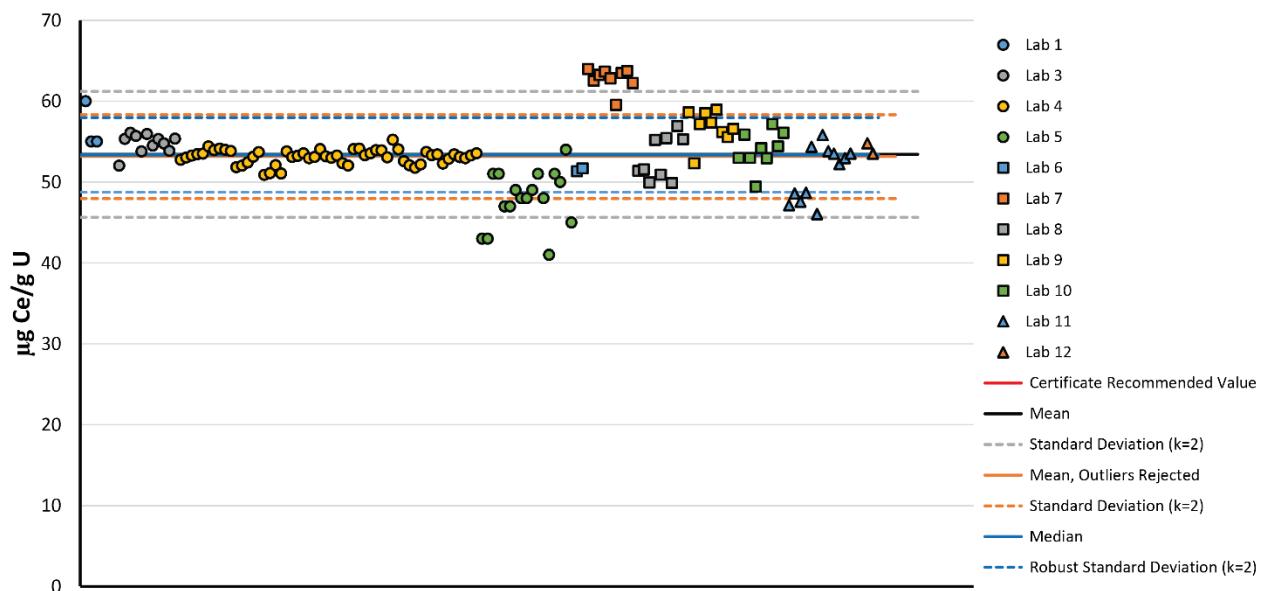
**Table A43** All data reported for CUP-2 La concentration. Data precision as laboratory reported.

Lab #	Sample #	[La] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[La] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[La] ( $\mu\text{g/gU}$ )
1	1	32	4	34	20.055	7	8	31.4332
1	2	26	4	35	19.986	7	9	30.5825
1	3	26	4	36	19.713	8	1	24.8
3	1	25.5	4	37	20.019	8	2	25.2
3	2	27.3	4	38	19.697	8	3	24.4
3	3	27.4	4	39	20.410	8	4	26.9
3	4	26.9	4	40	19.888	8	5	25.0
3	5	26.2	4	41	19.665	8	6	26.9
3	6	26.9	4	42	22.008	8	7	24.5
3	7	26.3	4	43	21.546	8	8	28.0
3	8	26.2	4	44	22.665	8	9	26.6
3	9	26.7	4	45	19.905	9	1	29.645
3	10	25.9	4	46	19.469	9	2	26.116
3	11	26.0	4	47	19.790	9	3	29.159
4	1	23.813	4	48	19.361	9	4	30.223
4	2	23.676	4	49	19.577	9	5	30.848
4	3	23.898	4	50	19.421	9	6	30.700
4	4	23.816	4	51	19.662	9	7	30.134
4	5	23.875	4	52	19.340	9	8	29.216
4	6	23.631	4	53	19.656	9	9	28.800
4	7	23.366	4	54	20.062	10	1	25.91
4	8	23.649	5	1	20.93	10	2	27.10
4	9	23.534	5	2	20.93	10	3	26.47
4	10	23.752	5	3	25.23	10	4	24.08
4	11	23.385	5	4	25.03	10	5	26.38
4	12	23.333	5	5	22.93	10	6	25.87
4	13	23.394	5	6	22.93	10	7	27.59
4	14	23.665	5	7	23.93	10	8	26.64
4	15	23.819	5	8	22.93	10	9	27.33
4	16	20.933	5	9	22.93	11	1	25.28
4	17	21.569	5	10	23.93	11	2	24.97
4	18	22.194	5	11	24.93	11	3	24.17
4	19	22.141	5	12	23.33	11	4	25.95
4	20	20.195	5	13	20.23	11	5	28.80
4	21	19.893	5	14	25.40	11	6	24.91
4	22	19.664	5	15	24.80	11	7	26.33
4	23	19.660	5	16	27.10	11	8	25.62
4	24	19.924	5	17	22.60	11	9	25.60
4	25	19.632	6	1	25.32468	11	10	24.86
4	26	19.866	6	2	25.46780	11	11	25.19
4	27	19.450	7	1	31.4909	11	12	25.35
4	28	19.514	7	2	30.7466	12	1	
4	29	22.163	7	3	31.1092	12	2	
4	30	22.517	7	4	31.2173	12	3	
4	31	22.567	7	5	30.9111	12	4	
4	32	20.195	7	6	29.3745			
4	33	20.552	7	7	31.2742			



**Table A44** All data reported for CUP-2 Ce concentration. Data precision as laboratory reported.

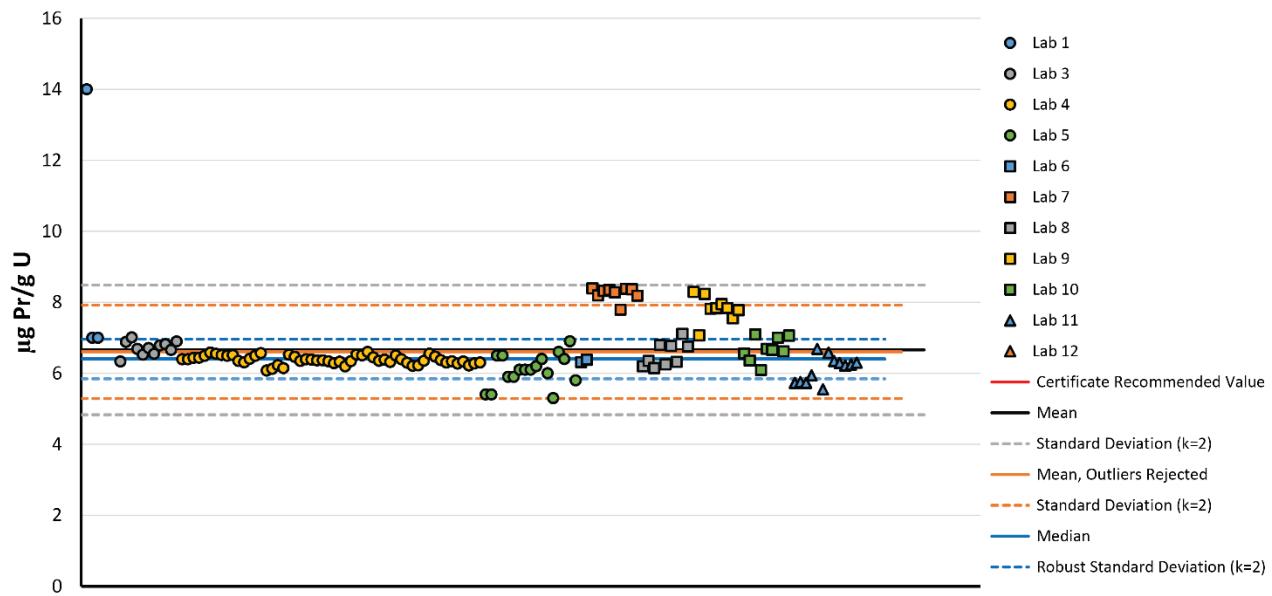
Lab #	Sample #	[Ce] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ce] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ce] ( $\mu\text{g/gU}$ )
1	1	60	4	34	53.307	7	8	63.7407
1	2	55	4	35	53.549	7	9	62.2245
1	3	55	4	36	53.936	8	1	51.4
3	1	52.0	4	37	53.905	8	2	51.5
3	2	55.3	4	38	53.050	8	3	49.9
3	3	56.1	4	39	55.229	8	4	55.2
3	4	55.7	4	40	54.035	8	5	50.9
3	5	53.8	4	41	52.580	8	6	55.4
3	6	55.9	4	42	52.060	8	7	49.9
3	7	54.5	4	43	51.766	8	8	56.9
3	8	55.3	4	44	52.178	8	9	55.3
3	9	54.8	4	45	53.725	9	1	58.609
3	10	53.8	4	46	53.315	9	2	52.289
3	11	55.3	4	47	53.406	9	3	57.149
4	1	52.749	4	48	52.270	9	4	58.529
4	2	53.039	4	49	52.866	9	5	57.352
4	3	53.266	4	50	53.409	9	6	58.941
4	4	53.428	4	51	53.074	9	7	56.166
4	5	53.494	4	52	52.938	9	8	55.539
4	6	54.399	4	53	53.278	9	9	56.549
4	7	53.927	4	54	53.538	10	1	52.97
4	8	54.123	5	1	43	10	2	55.85
4	9	53.971	5	2	43	10	3	52.97
4	10	53.816	5	3	51	10	4	49.42
4	11	51.823	5	4	51	10	5	54.19
4	12	52.014	5	5	47	10	6	52.94
4	13	52.407	5	6	47	10	7	57.16
4	14	53.121	5	7	49	10	8	54.41
4	15	53.701	5	8	48	10	9	56.09
4	16	50.883	5	9	48	11	1	47.15
4	17	51.085	5	10	49	11	2	48.59
4	18	52.080	5	11	51	11	3	47.56
4	19	51.051	5	12	48	11	4	48.66
4	20	53.788	5	13	41	11	5	54.37
4	21	53.094	5	14	51	11	6	46.04
4	22	53.241	5	15	50	11	7	55.80
4	23	53.552	5	16	54	11	8	53.82
4	24	52.943	5	17	45	11	9	53.49
4	25	53.102	6	1	51.33125	11	10	52.22
4	26	54.065	6	2	51.68401	11	11	52.96
4	27	53.179	7	1	63.9752	11	12	53.50
4	28	52.990	7	2	62.5134	12	1	
4	29	53.260	7	3	63.2368	12	2	
4	30	52.330	7	4	63.6434	12	3	54.8
4	31	52.045	7	5	62.8181	12	4	53.5
4	32	54.059	7	6	59.5230			
4	33	54.131	7	7	63.4770			



**Figure A44.** All Ce concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A45** All data reported for CUP-2 Pr concentration. Data precision as laboratory reported.

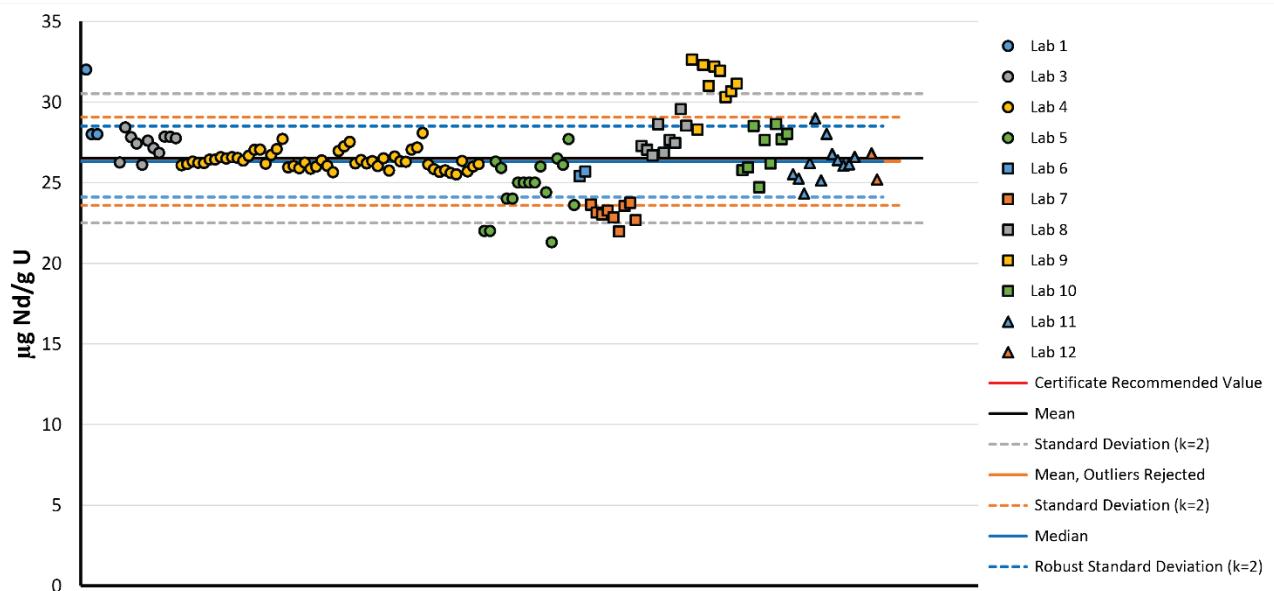
Lab #	Sample #	[Pr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pr] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pr] ( $\mu\text{g/gU}$ )
1	1	14	4	34	6.604	7	8	8.3681
1	2	7	4	35	6.450	7	9	8.1862
1	3	7	4	36	6.350	8	1	6.19
3	1	6.3	4	37	6.384	8	2	6.34
3	2	6.9	4	38	6.318	8	3	6.14
3	3	7.0	4	39	6.497	8	4	6.80
3	4	6.7	4	40	6.393	8	5	6.24
3	5	6.5	4	41	6.295	8	6	6.77
3	6	6.7	4	42	6.208	8	7	6.32
3	7	6.5	4	43	6.223	8	8	7.11
3	8	6.8	4	44	6.353	8	9	6.75
3	9	6.8	4	45	6.553	9	1	8.292
3	10	6.7	4	46	6.468	9	2	7.069
3	11	6.9	4	47	6.371	9	3	8.231
4	1	6.397	4	48	6.302	9	4	7.817
4	2	6.394	4	49	6.337	9	5	7.831
4	3	6.436	4	50	6.274	9	6	7.943
4	4	6.437	4	51	6.332	9	7	7.836
4	5	6.494	4	52	6.219	9	8	7.545
4	6	6.584	4	53	6.279	9	9	7.777
4	7	6.547	4	54	6.300	10	1	6.55
4	8	6.515	5	1	5.4	10	2	6.36
4	9	6.494	5	2	5.4	10	3	7.09
4	10	6.511	5	3	6.5	10	4	6.08
4	11	6.345	5	4	6.5	10	5	6.69
4	12	6.309	5	5	5.9	10	6	6.65
4	13	6.406	5	6	5.9	10	7	7.00
4	14	6.493	5	7	6.1	10	8	6.62
4	15	6.567	5	8	6.1	10	9	7.06
4	16	6.077	5	9	6.1	11	1	5.73
4	17	6.124	5	10	6.2	11	2	5.76
4	18	6.229	5	11	6.4	11	3	5.73
4	19	6.144	5	12	6.0	11	4	5.94
4	20	6.523	5	13	5.3	11	5	6.68
4	21	6.464	5	14	6.6	11	6	5.54
4	22	6.347	5	15	6.4	11	7	6.58
4	23	6.391	5	16	6.9	11	8	6.34
4	24	6.384	5	17	5.8	11	9	6.29
4	25	6.358	6	1	6.308715	11	10	6.22
4	26	6.364	6	2	6.381028	11	11	6.25
4	27	6.335	7	1	8.3910	11	12	6.30
4	28	6.283	7	2	8.1871	12	1	
4	29	6.327	7	3	8.3212	12	2	
4	30	6.192	7	4	8.3490	12	3	
4	31	6.340	7	5	8.2787	12	4	
4	32	6.527	7	6	7.7898			
4	33	6.503	7	7	8.3748			



**Figure A45.** All Pr concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A46** All data reported for CUP-2 Nd concentration. Data precision as laboratory reported.

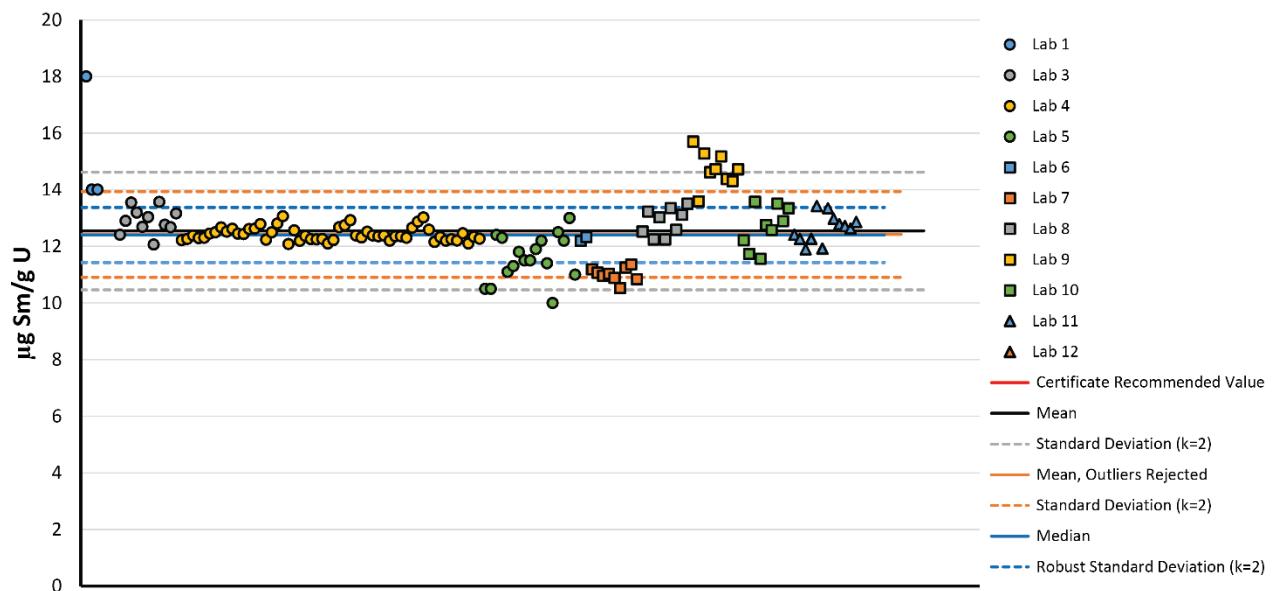
Lab #	Sample #	[Nd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Nd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Nd] ( $\mu\text{g/gU}$ )
1	1	32	4	34	26.189	7	8	23.7493
1	2	28	4	35	26.334	7	9	22.6715
1	3	28	4	36	26.018	8	1	27.3
3	1	26.2	4	37	26.505	8	2	27.0
3	2	28.4	4	38	25.747	8	3	26.7
3	3	27.8	4	39	26.617	8	4	28.6
3	4	27.4	4	40	26.320	8	5	26.8
3	5	26.1	4	41	26.284	8	6	27.6
3	6	27.6	4	42	27.042	8	7	27.5
3	7	27.1	4	43	27.172	8	8	29.6
3	8	26.8	4	44	28.071	8	9	28.5
3	9	27.9	4	45	26.128	9	1	32.623
3	10	27.8	4	46	25.833	9	2	28.278
3	11	27.7	4	47	25.663	9	3	32.298
4	1	26.071	4	48	25.764	9	4	31.002
4	2	26.144	4	49	25.596	9	5	32.190
4	3	26.300	4	50	25.513	9	6	31.932
4	4	26.222	4	51	26.345	9	7	30.292
4	5	26.211	4	52	25.689	9	8	30.654
4	6	26.435	4	53	25.996	9	9	31.130
4	7	26.425	4	54	26.144	10	1	25.77
4	8	26.573	5	1	22.0	10	2	25.95
4	9	26.492	5	2	22.0	10	3	28.51
4	10	26.569	5	3	26.3	10	4	24.71
4	11	26.525	5	4	25.9	10	5	27.64
4	12	26.350	5	5	24.0	10	6	26.19
4	13	26.654	5	6	24.0	10	7	28.63
4	14	27.041	5	7	25.0	10	8	27.68
4	15	27.044	5	8	25.0	10	9	28.02
4	16	26.165	5	9	25.0	11	1	25.52
4	17	26.711	5	10	25.0	11	2	25.25
4	18	27.083	5	11	26.0	11	3	24.32
4	19	27.712	5	12	24.4	11	4	26.21
4	20	25.942	5	13	21.3	11	5	28.98
4	21	26.024	5	14	26.5	11	6	25.13
4	22	25.890	5	15	26.1	11	7	28.02
4	23	26.232	5	16	27.7	11	8	26.76
4	24	25.853	5	17	23.6	11	9	26.40
4	25	25.987	6	1	25.39754	11	10	26.05
4	26	26.372	6	2	25.68385	11	11	26.14
4	27	26.036	7	1	23.6218	11	12	26.58
4	28	25.641	7	2	23.1409	12	1	
4	29	26.960	7	3	23.0246	12	2	
4	30	27.246	7	4	23.2628	12	3	26.8
4	31	27.525	7	5	22.8360	12	4	25.2
4	32	26.196	7	6	21.9709			
4	33	26.402	7	7	23.5481			



**Figure A46.** All Nd concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A47** All data reported for CUP-2 Sm concentration. Data precision as laboratory reported.

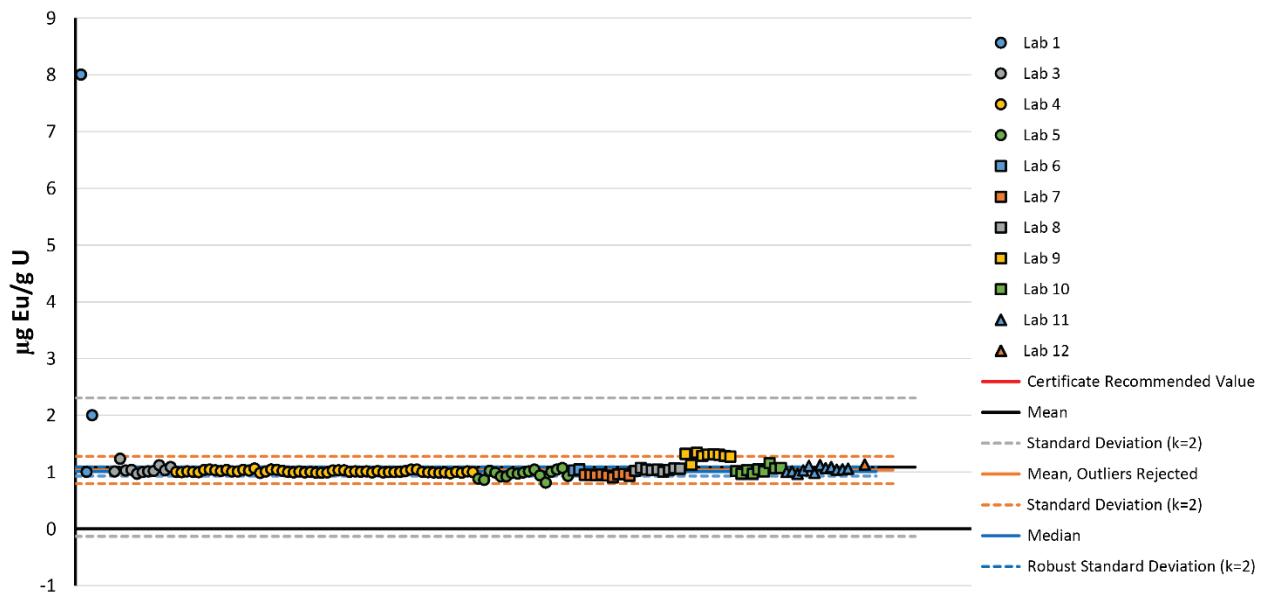
Lab #	Sample #	[Sm] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sm] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Sm] ( $\mu\text{g/gU}$ )
1	1	18	4	34	12.514	7	8	11.3571
1	2	14	4	35	12.380	7	9	10.8294
1	3	14	4	36	12.352	8	1	12.5
3	1	12.4	4	37	12.382	8	2	13.2
3	2	12.9	4	38	12.196	8	3	12.2
3	3	13.5	4	39	12.352	8	4	13.0
3	4	13.2	4	40	12.354	8	5	12.2
3	5	12.7	4	41	12.301	8	6	13.3
3	6	13.0	4	42	12.657	8	7	12.6
3	7	12.1	4	43	12.873	8	8	13.1
3	8	13.6	4	44	13.020	8	9	13.5
3	9	12.8	4	45	12.583	9	1	15.694
3	10	12.7	4	46	12.154	9	2	13.590
3	11	13.2	4	47	12.318	9	3	15.276
4	1	12.217	4	48	12.199	9	4	14.613
4	2	12.256	4	49	12.248	9	5	14.724
4	3	12.381	4	50	12.205	9	6	15.171
4	4	12.292	4	51	12.455	9	7	14.381
4	5	12.303	4	52	12.101	9	8	14.297
4	6	12.449	4	53	12.335	9	9	14.720
4	7	12.494	4	54	12.263	10	1	12.21
4	8	12.665	5	1	10.5	10	2	11.73
4	9	12.516	5	2	10.5	10	3	13.57
4	10	12.618	5	3	12.4	10	4	11.56
4	11	12.444	5	4	12.3	10	5	12.75
4	12	12.434	5	5	11.1	10	6	12.57
4	13	12.610	5	6	11.3	10	7	13.51
4	14	12.625	5	7	11.8	10	8	12.89
4	15	12.786	5	8	11.5	10	9	13.34
4	16	12.236	5	9	11.5	11	1	12.41
4	17	12.492	5	10	11.9	11	2	12.26
4	18	12.805	5	11	12.2	11	3	11.89
4	19	13.060	5	12	11.4	11	4	12.26
4	20	12.078	5	13	10.0	11	5	13.43
4	21	12.564	5	14	12.5	11	6	11.92
4	22	12.188	5	15	12.2	11	7	13.35
4	23	12.362	5	16	13.0	11	8	12.98
4	24	12.251	5	17	11.0	11	9	12.78
4	25	12.248	6	1	12.18739	11	10	12.72
4	26	12.256	6	2	12.32071	11	11	12.63
4	27	12.101	7	1	11.1831	11	12	12.86
4	28	12.219	7	2	11.0640	12	1	
4	29	12.675	7	3	10.9544	12	2	
4	30	12.741	7	4	11.0208	12	3	
4	31	12.918	7	5	10.8796	12	4	
4	32	12.380	7	6	10.5227			
4	33	12.306	7	7	11.2473			



**Figure A47.** All Sm concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A48** All data reported for CUP-2 Eu concentration. Data precision as laboratory reported.

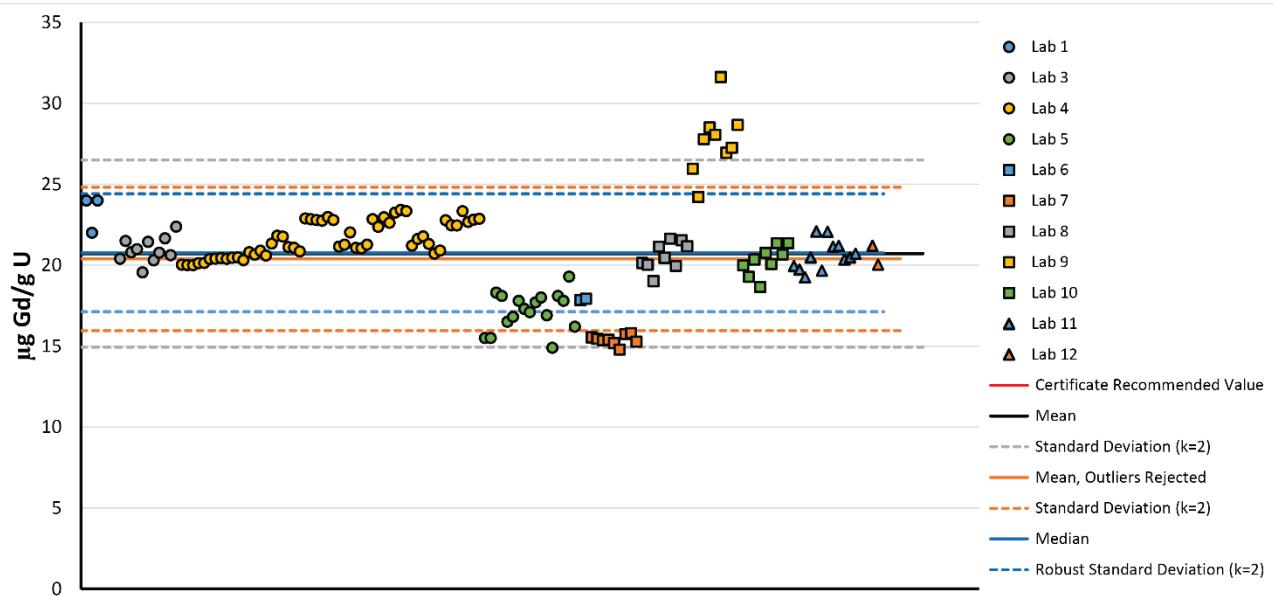
Lab #	Sample #	[Eu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Eu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Eu] ( $\mu\text{g/gU}$ )
1	1	8	4	34	1.005	7	8	0.9635
1	2	1	4	35	1.010	7	9	0.9321
1	3	2	4	36	0.991	8	1	1.02
3	1	1.0	4	37	1.015	8	2	1.07
3	2	1.2	4	38	0.993	8	3	1.04
3	3	1.0	4	39	0.997	8	4	1.03
3	4	1.0	4	40	0.997	8	5	1.04
3	5	1.0	4	41	1.001	8	6	1.00
3	6	1.0	4	42	1.015	8	7	1.03
3	7	1.0	4	43	1.042	8	8	1.06
3	8	1.0	4	44	1.040	8	9	1.06
3	9	1.1	4	45	1.000	9	1	1.317
3	10	1.0	4	46	0.996	9	2	1.125
3	11	1.1	4	47	0.990	9	3	1.335
4	1	1.002	4	48	0.986	9	4	1.283
4	2	0.995	4	49	0.991	9	5	1.305
4	3	1.010	4	50	0.976	9	6	1.313
4	4	1.000	4	51	1.004	9	7	1.301
4	5	0.996	4	52	0.987	9	8	1.279
4	6	1.034	4	53	1.010	9	9	1.269
4	7	1.040	4	54	0.999	10	1	1.01
4	8	1.028	5	1	0.88	10	2	0.97
4	9	1.017	5	2	0.86	10	3	1.03
4	10	1.036	5	3	1.02	10	4	0.97
4	11	1.008	5	4	0.99	10	5	1.04
4	12	1.009	5	5	0.92	10	6	1.01
4	13	1.039	5	6	0.92	10	7	1.15
4	14	1.026	5	7	0.98	10	8	1.06
4	15	1.063	5	8	0.97	10	9	1.07
4	16	0.983	5	9	0.99	11	1	1.00
4	17	1.008	5	10	1.01	11	2	1.01
4	18	1.043	5	11	1.04	11	3	0.97
4	19	1.038	5	12	0.94	11	4	1.03
4	20	1.018	5	13	0.81	11	5	1.11
4	21	1.000	5	14	1.00	11	6	0.98
4	22	0.993	5	15	1.04	11	7	1.12
4	23	1.006	5	16	1.07	11	8	1.07
4	24	0.991	5	17	0.93	11	9	1.09
4	25	1.002	6	1	1.025754	11	10	1.04
4	26	0.985	6	2	1.045532	11	11	1.05
4	27	0.985	7	1	0.9497	11	12	1.06
4	28	0.993	7	2	0.9491	12	1	
4	29	1.027	7	3	0.9404	12	2	
4	30	1.027	7	4	0.9563	12	3	1.13
4	31	1.030	7	5	0.9367	12	4	
4	32	1.002	7	6	0.9044			
4	33	1.012	7	7	0.9574			



**Figure A48.** All Eu concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A49** All data reported for CUP-2 Gd concentration. Data precision as laboratory reported.

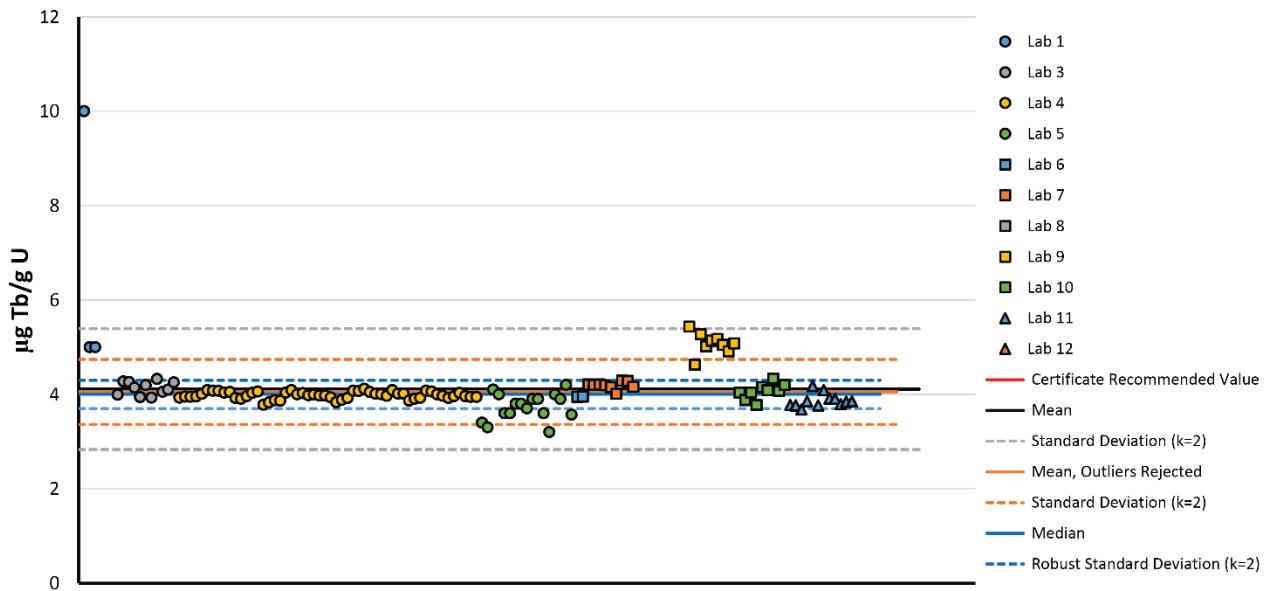
Lab #	Sample #	[Gd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Gd] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Gd] ( $\mu\text{g/gU}$ )
1	1	24	4	34	21.274	7	8	15.7964
1	2	22	4	35	22.842	7	9	15.2785
1	3	24	4	36	22.363	8	1	20.1
3	1	20.4	4	37	22.962	8	2	20.0
3	2	21.5	4	38	22.613	8	3	19.0
3	3	20.8	4	39	23.248	8	4	21.2
3	4	21.0	4	40	23.419	8	5	20.4
3	5	19.5	4	41	23.335	8	6	21.6
3	6	21.4	4	42	21.203	8	7	19.9
3	7	20.3	4	43	21.613	8	8	21.5
3	8	20.8	4	44	21.778	8	9	21.2
3	9	21.7	4	45	21.312	9	1	25.957
3	10	20.6	4	46	20.715	9	2	24.217
3	11	22.4	4	47	20.907	9	3	27.786
4	1	20.023	4	48	22.781	9	4	28.508
4	2	20.010	4	49	22.461	9	5	28.064
4	3	19.999	4	50	22.452	9	6	31.625
4	4	20.130	4	51	23.341	9	7	26.952
4	5	20.139	4	52	22.668	9	8	27.258
4	6	20.381	4	53	22.825	9	9	28.667
4	7	20.403	4	54	22.869	10	1	19.98
4	8	20.437	5	1	15.5	10	2	19.29
4	9	20.391	5	2	15.5	10	3	20.35
4	10	20.455	5	3	18.3	10	4	18.65
4	11	20.480	5	4	18.1	10	5	20.76
4	12	20.311	5	5	16.5	10	6	20.07
4	13	20.809	5	6	16.8	10	7	21.35
4	14	20.653	5	7	17.8	10	8	20.65
4	15	20.891	5	8	17.3	10	9	21.36
4	16	20.597	5	9	17.1	11	1	19.96
4	17	21.332	5	10	17.7	11	2	19.73
4	18	21.815	5	11	18.0	11	3	19.25
4	19	21.767	5	12	16.9	11	4	20.48
4	20	21.117	5	13	14.9	11	5	22.09
4	21	21.078	5	14	18.1	11	6	19.66
4	22	20.850	5	15	17.8	11	7	22.06
4	23	22.890	5	16	19.3	11	8	21.15
4	24	22.835	5	17	16.2	11	9	21.19
4	25	22.793	6	1	17.84011	11	10	20.35
4	26	22.743	6	2	17.93019	11	11	20.48
4	27	22.977	7	1	15.5429	11	12	20.71
4	28	22.790	7	2	15.4493	12	1	
4	29	21.151	7	3	15.3500	12	2	
4	30	21.267	7	4	15.3879	12	3	21.20
4	31	22.027	7	5	15.1862	12	4	20.04
4	32	21.079	7	6	14.7889			
4	33	21.040	7	7	15.7492			



**Figure A49.** All Gd concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A50** All data reported for CUP-2 Tb concentration. Data precision as laboratory reported.

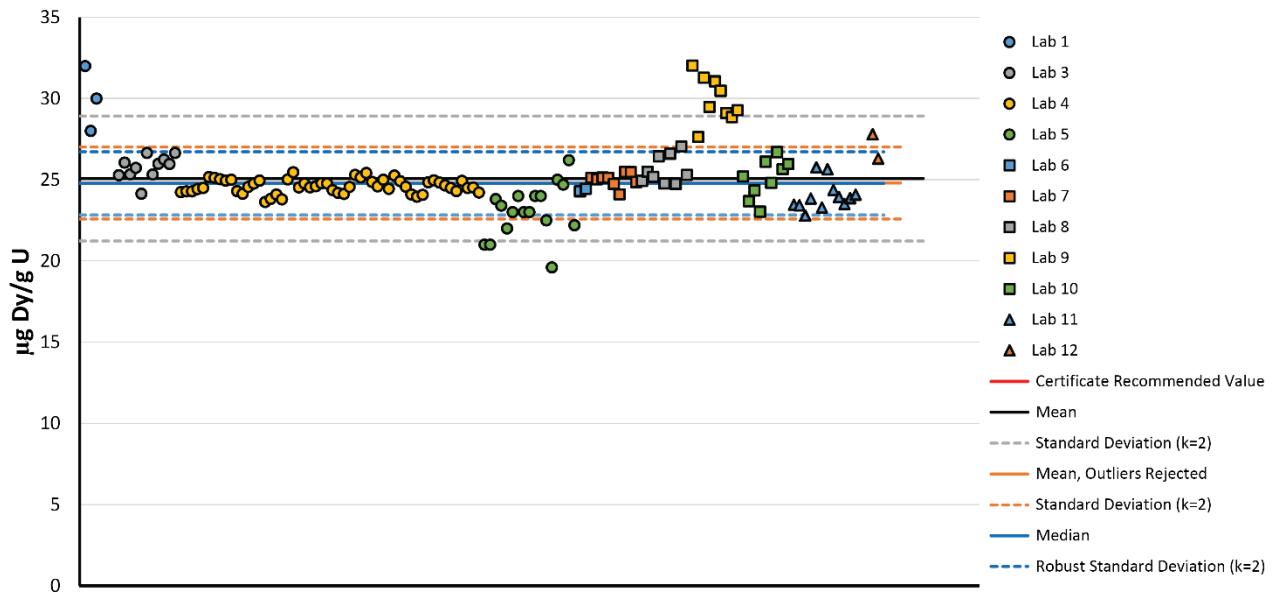
Lab #	Sample #	[Tb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tb] ( $\mu\text{g/gU}$ )
1	1	10	4	34	4.118	7	8	4.2819
1	2	5	4	35	4.048	7	9	4.1573
1	3	5	4	36	4.010	8	1	
3	1	4.0	4	37	4.004	8	2	
3	2	4.3	4	38	3.965	8	3	
3	3	4.3	4	39	4.088	8	4	
3	4	4.1	4	40	4.015	8	5	
3	5	3.9	4	41	4.017	8	6	
3	6	4.2	4	42	3.868	8	7	
3	7	3.9	4	43	3.903	8	8	
3	8	4.3	4	44	3.926	8	9	
3	9	4.1	4	45	4.078	9	1	5.434
3	10	4.1	4	46	4.060	9	2	4.626
3	11	4.3	4	47	3.999	9	3	5.270
4	1	3.930	4	48	3.968	9	4	5.015
4	2	3.952	4	49	3.924	9	5	5.136
4	3	3.950	4	50	3.962	9	6	5.174
4	4	3.956	4	51	4.029	9	7	5.046
4	5	4.006	4	52	3.965	9	8	4.911
4	6	4.089	4	53	3.945	9	9	5.076
4	7	4.077	4	54	3.944	10	1	4.03
4	8	4.073	5	1	3.40	10	2	3.88
4	9	4.037	5	2	3.30	10	3	4.03
4	10	4.049	5	3	4.10	10	4	3.77
4	11	3.925	5	4	4.00	10	5	4.15
4	12	3.906	5	5	3.60	10	6	4.09
4	13	3.961	5	6	3.60	10	7	4.33
4	14	4.030	5	7	3.80	10	8	4.07
4	15	4.058	5	8	3.80	10	9	4.20
4	16	3.779	5	9	3.70	11	1	3.77
4	17	3.828	5	10	3.90	11	2	3.77
4	18	3.874	5	11	3.90	11	3	3.68
4	19	3.865	5	12	3.60	11	4	3.85
4	20	4.038	5	13	3.20	11	5	4.17
4	21	4.088	5	14	4.00	11	6	3.76
4	22	3.999	5	15	3.90	11	7	4.09
4	23	4.025	5	16	4.20	11	8	3.91
4	24	3.980	5	17	3.57	11	9	3.90
4	25	3.997	6	1	3.945084	11	10	3.79
4	26	3.975	6	2	3.953462	11	11	3.84
4	27	3.976	7	1	4.2077	11	12	3.85
4	28	3.935	7	2	4.2011	12	1	
4	29	3.834	7	3	4.2080	12	2	
4	30	3.882	7	4	4.1926	12	3	
4	31	3.922	7	5	4.1465	12	4	
4	32	4.076	7	6	4.0074			
4	33	4.069	7	7	4.2891			



**Figure A50.** All Tb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A51** All data reported for CUP-2 Dy concentration. Data precision as laboratory reported.

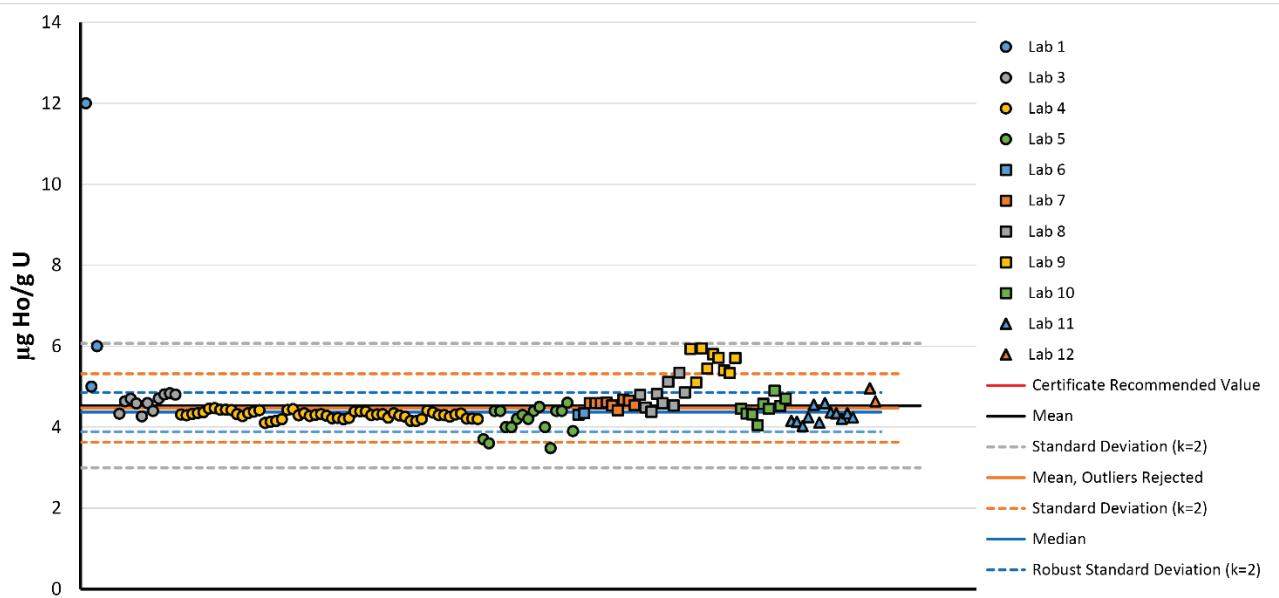
Lab #	Sample #	[Dy] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Dy] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Dy] ( $\mu\text{g/gU}$ )
1	1	32	4	34	25.423	7	8	25.4744
1	2	28	4	35	24.869	7	9	24.8545
1	3	30	4	36	24.593	8	1	24.9
3	1	25.3	4	37	25.002	8	2	25.5
3	2	26.1	4	38	24.434	8	3	25.2
3	3	25.3	4	39	25.254	8	4	26.4
3	4	25.7	4	40	24.911	8	5	24.8
3	5	24.1	4	41	24.571	8	6	26.6
3	6	26.6	4	42	24.088	8	7	24.7
3	7	25.3	4	43	23.954	8	8	27.0
3	8	26.0	4	44	24.071	8	9	25.3
3	9	26.2	4	45	24.851	9	1	32.017
3	10	26.0	4	46	24.968	9	2	27.628
3	11	26.6	4	47	24.831	9	3	31.275
4	1	24.237	4	48	24.654	9	4	29.479
4	2	24.290	4	49	24.492	9	5	31.053
4	3	24.287	4	50	24.293	9	6	30.471
4	4	24.427	4	51	24.938	9	7	29.102
4	5	24.490	4	52	24.491	9	8	28.857
4	6	25.163	4	53	24.519	9	9	29.276
4	7	25.114	4	54	24.208	10	1	25.21
4	8	25.031	5	1	21.0	10	2	23.67
4	9	24.947	5	2	21.0	10	3	24.34
4	10	24.994	5	3	23.8	10	4	23.02
4	11	24.294	5	4	23.4	10	5	26.11
4	12	24.139	5	5	22.0	10	6	24.81
4	13	24.554	5	6	23.0	10	7	26.70
4	14	24.759	5	7	24.0	10	8	25.64
4	15	24.943	5	8	23.0	10	9	25.96
4	16	23.634	5	9	23.0	11	1	23.46
4	17	23.827	5	10	24.0	11	2	23.43
4	18	24.093	5	11	24.0	11	3	22.79
4	19	23.787	5	12	22.5	11	4	23.85
4	20	25.015	5	13	19.6	11	5	25.76
4	21	25.458	5	14	25.0	11	6	23.29
4	22	24.527	5	15	24.7	11	7	25.64
4	23	24.772	5	16	26.2	11	8	24.37
4	24	24.532	5	17	22.2	11	9	23.94
4	25	24.595	6	1	24.28616	11	10	23.52
4	26	24.786	6	2	24.43721	11	11	23.86
4	27	24.775	7	1	25.1193	11	12	24.08
4	28	24.362	7	2	25.0341	12	1	
4	29	24.192	7	3	25.1280	12	2	
4	30	24.128	7	4	25.1142	12	3	27.8
4	31	24.553	7	5	24.7369	12	4	26.3
4	32	25.299	7	6	24.1089			
4	33	25.135	7	7	25.4779			



**Figure A51.** All Dy concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A52** All data reported for CUP-2 Ho concentration. Data precision as laboratory reported.

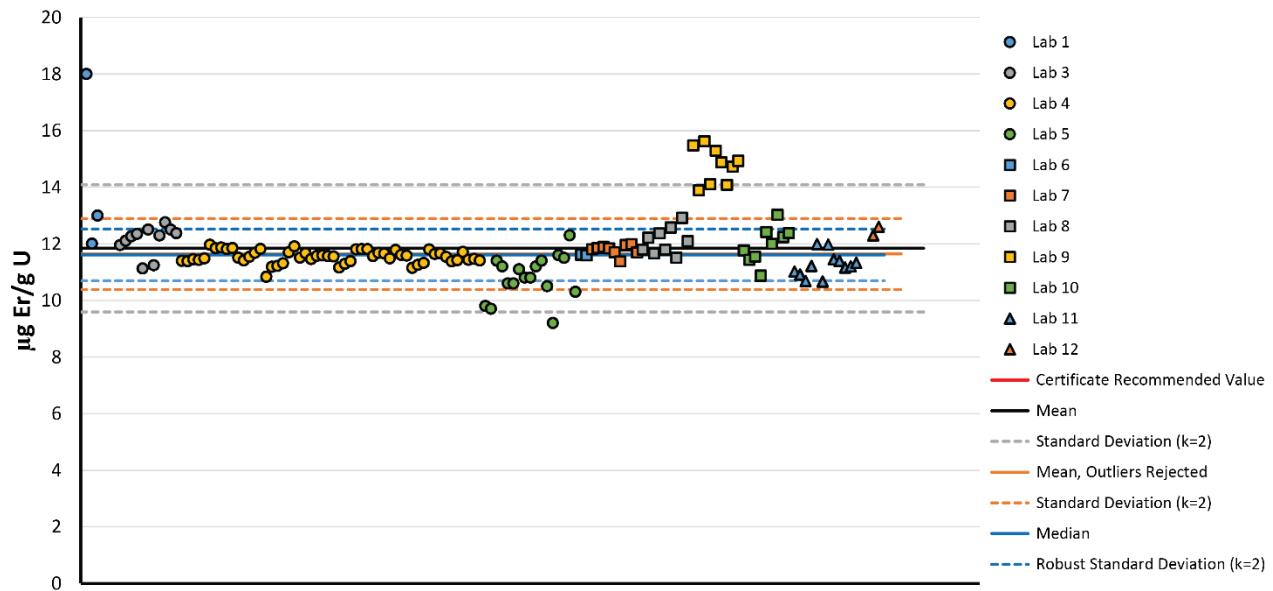
Lab #	Sample #	[Ho] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ho] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ho] ( $\mu\text{g/gU}$ )
1	1	12	4	34	4.388	7	8	4.6512
1	2	5	4	35	4.296	7	9	4.5369
1	3	6	4	36	4.314	8	1	4.79
3	1	4.3	4	37	4.319	8	2	4.48
3	2	4.6	4	38	4.229	8	3	4.38
3	3	4.7	4	39	4.343	8	4	4.82
3	4	4.6	4	40	4.288	8	5	4.59
3	5	4.3	4	41	4.259	8	6	5.12
3	6	4.6	4	42	4.153	8	7	4.53
3	7	4.4	4	43	4.149	8	8	5.35
3	8	4.7	4	44	4.196	8	9	4.85
3	9	4.8	4	45	4.409	9	1	5.928
3	10	4.8	4	46	4.359	9	2	5.102
3	11	4.8	4	47	4.295	9	3	5.944
4	1	4.307	4	48	4.295	9	4	5.446
4	2	4.293	4	49	4.258	9	5	5.799
4	3	4.326	4	50	4.309	9	6	5.709
4	4	4.348	4	51	4.336	9	7	5.403
4	5	4.363	4	52	4.211	9	8	5.337
4	6	4.455	4	53	4.209	9	9	5.707
4	7	4.466	4	54	4.198	10	1	4.45
4	8	4.431	5	1	3.70	10	2	4.34
4	9	4.431	5	2	3.60	10	3	4.31
4	10	4.421	5	3	4.40	10	4	4.04
4	11	4.320	5	4	4.40	10	5	4.57
4	12	4.271	5	5	4.00	10	6	4.45
4	13	4.345	5	6	4.00	10	7	4.90
4	14	4.380	5	7	4.20	10	8	4.52
4	15	4.416	5	8	4.30	10	9	4.70
4	16	4.102	5	9	4.20	11	1	4.15
4	17	4.134	5	10	4.40	11	2	4.13
4	18	4.155	5	11	4.50	11	3	4.03
4	19	4.192	5	12	4.00	11	4	4.25
4	20	4.424	5	13	3.48	11	5	4.55
4	21	4.442	5	14	4.40	11	6	4.11
4	22	4.293	5	15	4.40	11	7	4.59
4	23	4.344	5	16	4.60	11	8	4.37
4	24	4.273	5	17	3.90	11	9	4.34
4	25	4.301	6	1	4.306148	11	10	4.21
4	26	4.317	6	2	4.341467	11	11	4.34
4	27	4.281	7	1	4.5933	11	12	4.24
4	28	4.215	7	2	4.5918	12	1	
4	29	4.228	7	3	4.5885	12	2	
4	30	4.194	7	4	4.6069	12	3	4.96
4	31	4.228	7	5	4.5331	12	4	4.64
4	32	4.386	7	6	4.4102			
4	33	4.392	7	7	4.6739			



**Figure A52.** All Ho concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A53** All data reported for CUP-2 Er concentration. Data precision as laboratory reported.

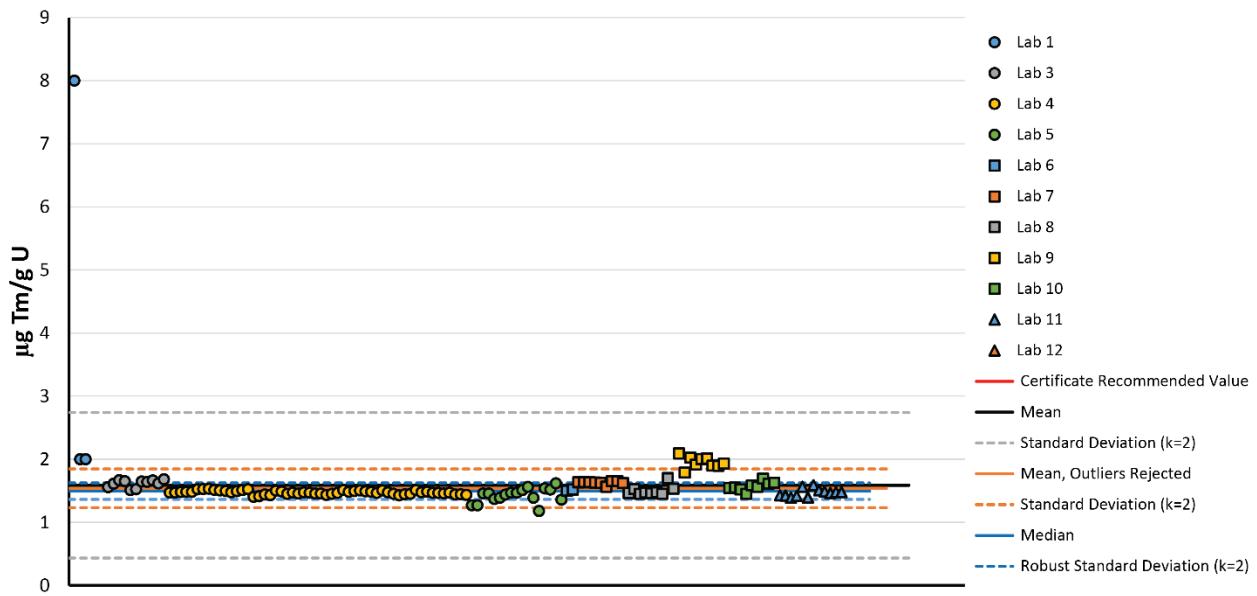
Lab #	Sample #	[Er] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Er] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Er] ( $\mu\text{g/gU}$ )
1	1	18	4	34	11.809	7	8	11.9847
1	2	12	4	35	11.564	7	9	11.6930
1	3	13	4	36	11.674	8	1	11.8
3	1	12.0	4	37	11.654	8	2	12.2
3	2	12.1	4	38	11.483	8	3	11.7
3	3	12.3	4	39	11.780	8	4	12.4
3	4	12.3	4	40	11.604	8	5	11.8
3	5	11.1	4	41	11.579	8	6	12.6
3	6	12.5	4	42	11.148	8	7	11.5
3	7	11.2	4	43	11.255	8	8	12.9
3	8	12.3	4	44	11.319	8	9	12.1
3	9	12.8	4	45	11.797	9	1	15.471
3	10	12.5	4	46	11.638	9	2	13.885
3	11	12.4	4	47	11.654	9	3	15.617
4	1	11.397	4	48	11.538	9	4	14.097
4	2	11.381	4	49	11.378	9	5	15.286
4	3	11.453	4	50	11.423	9	6	14.874
4	4	11.429	4	51	11.710	9	7	14.077
4	5	11.483	4	52	11.434	9	8	14.724
4	6	11.962	4	53	11.464	9	9	14.928
4	7	11.840	4	54	11.406	10	1	11.76
4	8	11.867	5	1	9.8	10	2	11.43
4	9	11.811	5	2	9.7	10	3	11.54
4	10	11.848	5	3	11.4	10	4	10.87
4	11	11.507	5	4	11.2	10	5	12.41
4	12	11.408	5	5	10.6	10	6	11.99
4	13	11.536	5	6	10.6	10	7	13.02
4	14	11.679	5	7	11.1	10	8	12.23
4	15	11.814	5	8	10.8	10	9	12.38
4	16	10.835	5	9	10.8	11	1	11.02
4	17	11.186	5	10	11.2	11	2	10.91
4	18	11.214	5	11	11.4	11	3	10.68
4	19	11.311	5	12	10.5	11	4	11.21
4	20	11.697	5	13	9.2	11	5	11.99
4	21	11.911	5	14	11.6	11	6	10.67
4	22	11.510	5	15	11.5	11	7	11.97
4	23	11.670	5	16	12.3	11	8	11.45
4	24	11.456	5	17	10.3	11	9	11.39
4	25	11.572	6	1	11.60992	11	10	11.16
4	26	11.590	6	2	11.58646	11	11	11.20
4	27	11.561	7	1	11.8059	11	12	11.33
4	28	11.549	7	2	11.8466	12	1	
4	29	11.158	7	3	11.8859	12	2	
4	30	11.293	7	4	11.8378	12	3	12.3
4	31	11.382	7	5	11.7005	12	4	12.6
4	32	11.806	7	6	11.3713			
4	33	11.809	7	7	11.9499			



**Figure A53.** All Er concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A54** All data reported for CUP-2 Tm concentration. Data precision as laboratory reported.

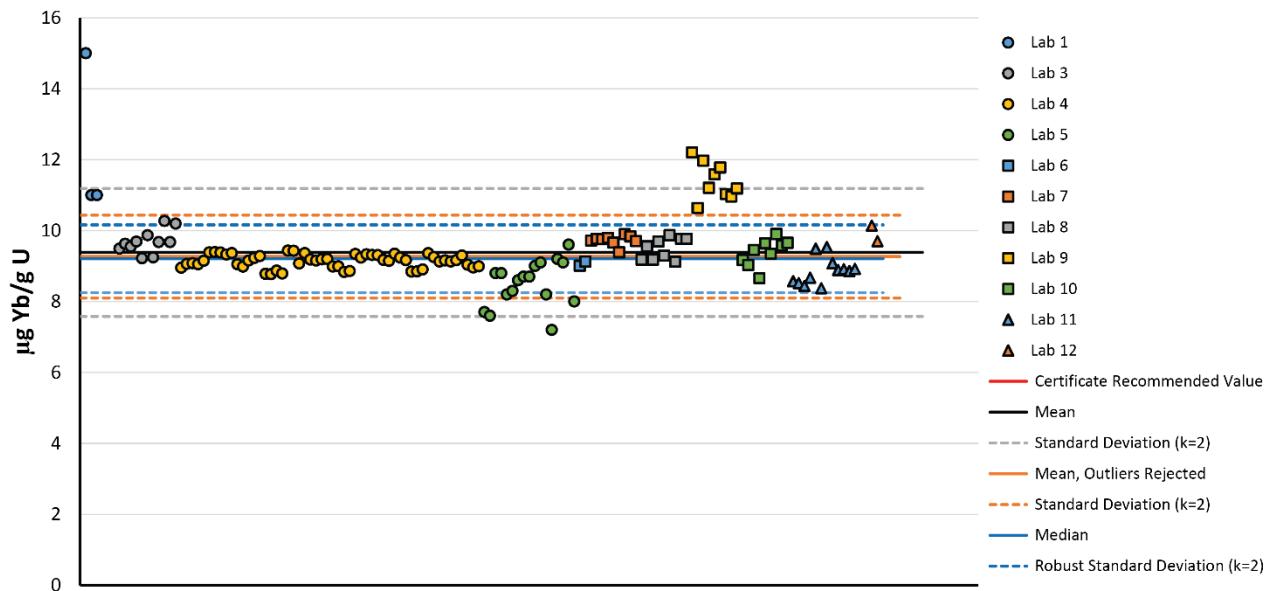
Lab #	Sample #	[Tm] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tm] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tm] ( $\mu\text{g/gU}$ )
1	1	8	4	34	1.498	7	8	1.6513
1	2	2	4	35	1.506	7	9	1.6217
1	3	2	4	36	1.491	8	1	1.47
3	1	1.6	4	37	1.483	8	2	1.53
3	2	1.6	4	38	1.466	8	3	1.45
3	3	1.7	4	39	1.508	8	4	1.47
3	4	1.7	4	40	1.475	8	5	1.46
3	5	1.5	4	41	1.454	8	6	1.48
3	6	1.5	4	42	1.429	8	7	1.45
3	7	1.6	4	43	1.445	8	8	1.70
3	8	1.6	4	44	1.453	8	9	1.53
3	9	1.7	4	45	1.511	9	1	2.092
3	10	1.6	4	46	1.475	9	2	1.788
3	11	1.7	4	47	1.485	9	3	2.025
4	1	1.472	4	48	1.467	9	4	1.916
4	2	1.472	4	49	1.468	9	5	2.002
4	3	1.482	4	50	1.458	9	6	2.011
4	4	1.483	4	51	1.470	9	7	1.897
4	5	1.484	4	52	1.441	9	8	1.895
4	6	1.525	4	53	1.444	9	9	1.930
4	7	1.529	4	54	1.437	10	1	1.54
4	8	1.534	5	1	1.27	10	2	1.55
4	9	1.513	5	2	1.27	10	3	1.52
4	10	1.506	5	3	1.46	10	4	1.45
4	11	1.497	5	4	1.46	10	5	1.59
4	12	1.475	5	5	1.37	10	6	1.56
4	13	1.495	5	6	1.39	10	7	1.69
4	14	1.513	5	7	1.44	10	8	1.61
4	15	1.524	5	8	1.47	10	9	1.63
4	16	1.405	5	9	1.47	11	1	1.43
4	17	1.416	5	10	1.51	11	2	1.43
4	18	1.441	5	11	1.56	11	3	1.39
4	19	1.430	5	12	1.39	11	4	1.42
4	20	1.503	5	13	1.18	11	5	1.56
4	21	1.489	5	14	1.54	11	6	1.39
4	22	1.452	5	15	1.52	11	7	1.59
4	23	1.473	5	16	1.62	11	8	1.51
4	24	1.457	5	17	1.36	11	9	1.49
4	25	1.475	6	1	1.501299	11	10	1.47
4	26	1.471	6	2	1.520514	11	11	1.48
4	27	1.456	7	1	1.6361	11	12	1.48
4	28	1.455	7	2	1.6369	12	1	
4	29	1.438	7	3	1.6372	12	2	
4	30	1.453	7	4	1.6294	12	3	
4	31	1.466	7	5	1.6244	12	4	
4	32	1.513	7	6	1.5640			
4	33	1.483	7	7	1.6526			



**Figure A54.** All Tm concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A55** All data reported for CUP-2 Yb concentration. Data precision as laboratory reported.

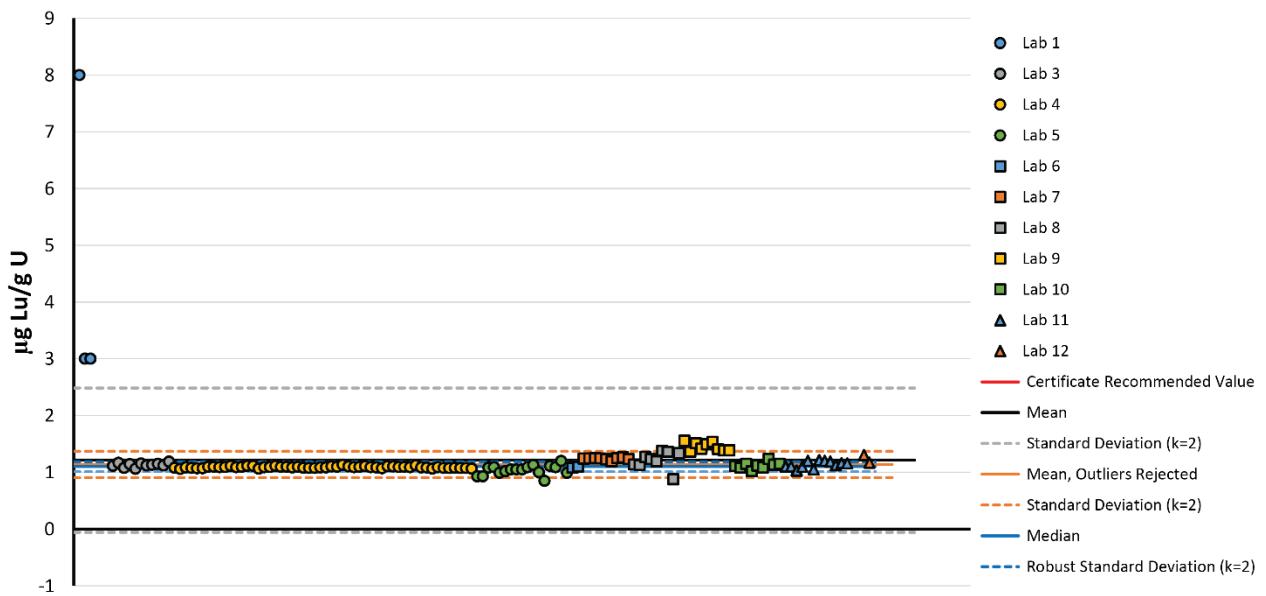
Lab #	Sample #	[Yb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Yb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Yb] ( $\mu\text{g/gU}$ )
1	1	15	4	34	9.333	7	8	9.8351
1	2	11	4	35	9.312	7	9	9.6980
1	3	11	4	36	9.309	8	1	9.18
3	1	9.5	4	37	9.176	8	2	9.55
3	2	9.6	4	38	9.146	8	3	9.18
3	3	9.5	4	39	9.348	8	4	9.69
3	4	9.7	4	40	9.240	8	5	9.29
3	5	9.2	4	41	9.162	8	6	9.87
3	6	9.9	4	42	8.845	8	7	9.12
3	7	9.2	4	43	8.847	8	8	9.76
3	8	9.7	4	44	8.902	8	9	9.76
3	9	10.3	4	45	9.360	9	1	12.202
3	10	9.7	4	46	9.252	9	2	10.637
3	11	10.2	4	47	9.123	9	3	11.971
4	1	8.950	4	48	9.158	9	4	11.201
4	2	9.060	4	49	9.123	9	5	11.583
4	3	9.081	4	50	9.164	9	6	11.779
4	4	9.053	4	51	9.296	9	7	11.031
4	5	9.148	4	52	9.038	9	8	10.962
4	6	9.383	4	53	8.958	9	9	11.185
4	7	9.397	4	54	8.991	10	1	9.17
4	8	9.382	5	1	7.7	10	2	9.03
4	9	9.328	5	2	7.6	10	3	9.45
4	10	9.364	5	3	8.8	10	4	8.65
4	11	9.051	5	4	8.8	10	5	9.64
4	12	8.983	5	5	8.2	10	6	9.35
4	13	9.153	5	6	8.3	10	7	9.90
4	14	9.226	5	7	8.6	10	8	9.58
4	15	9.284	5	8	8.7	10	9	9.65
4	16	8.778	5	9	8.7	11	1	8.57
4	17	8.769	5	10	9.0	11	2	8.52
4	18	8.870	5	11	9.1	11	3	8.44
4	19	8.791	5	12	8.2	11	4	8.67
4	20	9.435	5	13	7.2	11	5	9.49
4	21	9.431	5	14	9.2	11	6	8.38
4	22	9.071	5	15	9.1	11	7	9.53
4	23	9.365	5	16	9.6	11	8	9.08
4	24	9.182	5	17	8.0	11	9	8.89
4	25	9.156	6	1	9.006631	11	10	8.91
4	26	9.191	6	2	9.122283	11	11	8.86
4	27	9.196	7	1	9.7161	11	12	8.92
4	28	8.985	7	2	9.7644	12	1	
4	29	8.991	7	3	9.7580	12	2	
4	30	8.834	7	4	9.7939	12	3	10.14
4	31	8.860	7	5	9.6592	12	4	9.70
4	32	9.339	7	6	9.3834			
4	33	9.238	7	7	9.8954			



**Figure A55.** All Yb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A56** All data reported for CUP-2 Lu concentration. Data precision as laboratory reported.

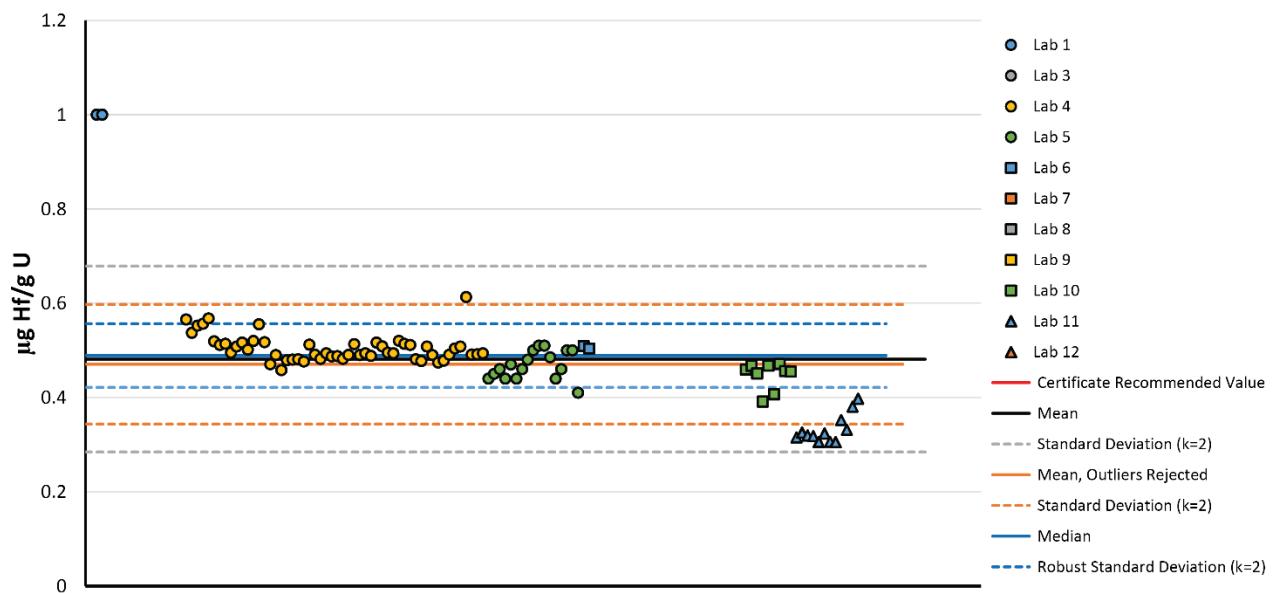
Lab #	Sample #	[Lu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Lu] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Lu] ( $\mu\text{g/gU}$ )
1	1	8	4	34	1.095	7	8	1.2627
1	2	3	4	35	1.108	7	9	1.2311
1	3	3	4	36	1.088	8	1	1.14
3	1	1.1	4	37	1.085	8	2	1.13
3	2	1.2	4	38	1.072	8	3	1.27
3	3	1.1	4	39	1.110	8	4	1.23
3	4	1.1	4	40	1.100	8	5	1.19
3	5	1.1	4	41	1.093	8	6	1.38
3	6	1.2	4	42	1.096	8	7	1.36
3	7	1.1	4	43	1.090	8	8	0.877
3	8	1.1	4	44	1.125	8	9	1.34
3	9	1.1	4	45	1.088	9	1	1.554
3	10	1.1	4	46	1.085	9	2	1.359
3	11	1.2	4	47	1.064	9	3	1.511
4	1	1.082	4	48	1.088	9	4	1.412
4	2	1.059	4	49	1.078	9	5	1.494
4	3	1.086	4	50	1.074	9	6	1.532
4	4	1.078	4	51	1.081	9	7	1.404
4	5	1.072	4	52	1.075	9	8	1.381
4	6	1.070	4	53	1.074	9	9	1.384
4	7	1.097	4	54	1.064	10	1	1.11
4	8	1.099	5	1	0.93	10	2	1.08
4	9	1.089	5	2	0.93	10	3	1.15
4	10	1.092	5	3	1.08	10	4	1.02
4	11	1.113	5	4	1.09	10	5	1.12
4	12	1.090	5	5	0.99	10	6	1.08
4	13	1.096	5	6	1.02	10	7	1.23
4	14	1.115	5	7	1.05	10	8	1.13
4	15	1.115	5	8	1.05	10	9	1.15
4	16	1.066	5	9	1.05	11	1	1.10
4	17	1.089	5	10	1.09	11	2	1.10
4	18	1.092	5	11	1.13	11	3	1.03
4	19	1.113	5	12	1.00	11	4	1.10
4	20	1.095	5	13	0.85	11	5	1.20
4	21	1.098	5	14	1.11	11	6	1.05
4	22	1.085	5	15	1.09	11	7	1.21
4	23	1.097	5	16	1.20	11	8	1.20
4	24	1.079	5	17	0.99	11	9	1.19
4	25	1.078	6	1	1.080590	11	10	1.13
4	26	1.078	6	2	1.098200	11	11	1.16
4	27	1.088	7	1	1.2395	11	12	1.16
4	28	1.086	7	2	1.2447	12	1	
4	29	1.104	7	3	1.2491	12	2	
4	30	1.097	7	4	1.2444	12	3	1.30
4	31	1.131	7	5	1.2267	12	4	1.17
4	32	1.106	7	6	1.1900			
4	33	1.091	7	7	1.2503			



**Figure A56.** All Lu concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A57** All data reported for CUP-2 Hf concentration. Data precision as laboratory reported.

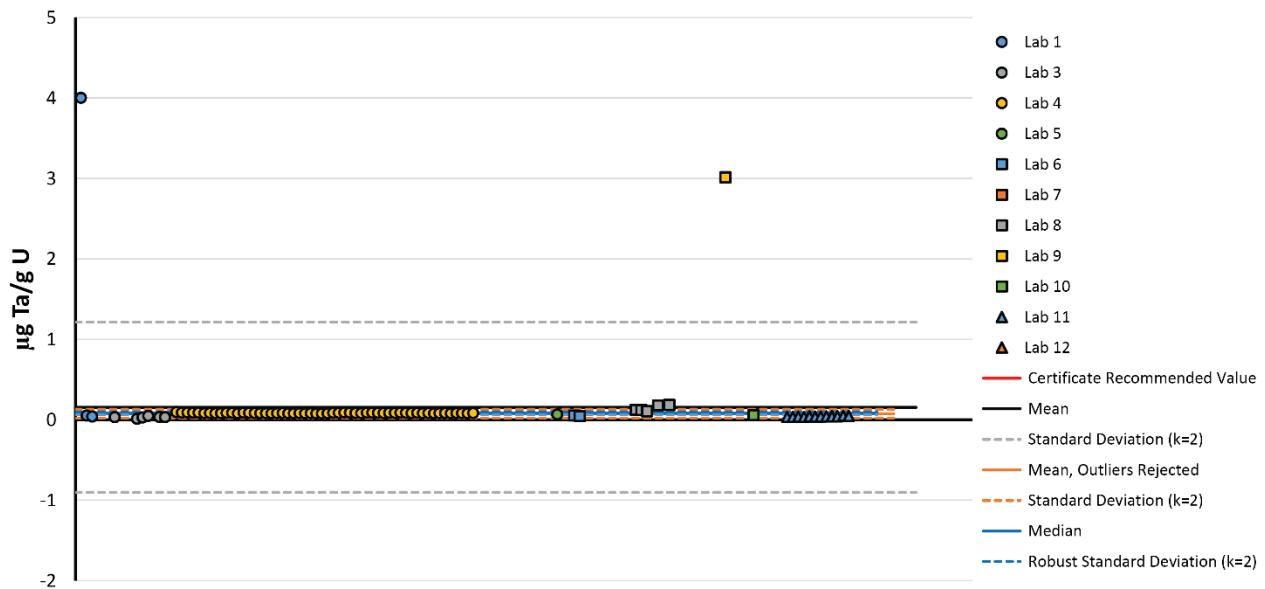
Lab #	Sample #	[Hf] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Hf] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Hf] ( $\mu\text{g/gU}$ )
1	1		4	34	0.488	7	8	
1	2	1	4	35	0.516	7	9	
1	3	1	4	36	0.509	8	1	
3	1		4	37	0.495	8	2	
3	2		4	38	0.494	8	3	
3	3		4	39	0.520	8	4	
3	4		4	40	0.514	8	5	
3	5		4	41	0.511	8	6	
3	6		4	42	0.481	8	7	
3	7		4	43	0.478	8	8	
3	8		4	44	0.508	8	9	
3	9		4	45	0.490	9	1	
3	10		4	46	0.474	9	2	
3	11		4	47	0.478	9	3	
4	1	0.565	4	48	0.491	9	4	
4	2	0.537	4	49	0.504	9	5	
4	3	0.552	4	50	0.508	9	6	
4	4	0.557	4	51	0.613	9	7	
4	5	0.568	4	52	0.491	9	8	
4	6	0.519	4	53	0.491	9	9	
4	7	0.512	4	54	0.494	10	1	0.46
4	8	0.514	5	1	0.44	10	2	0.47
4	9	0.495	5	2	0.45	10	3	0.45
4	10	0.508	5	3	0.46	10	4	0.39
4	11	0.517	5	4	0.44	10	5	0.47
4	12	0.501	5	5	0.47	10	6	0.41
4	13	0.520	5	6	0.44	10	7	0.47
4	14	0.555	5	7	0.46	10	8	0.46
4	15	0.517	5	8	0.48	10	9	0.45
4	16	0.470	5	9	0.50	11	1	0.32
4	17	0.490	5	10	0.51	11	2	0.33
4	18	0.458	5	11	0.51	11	3	0.32
4	19	0.479	5	12	0.49	11	4	0.32
4	20	0.480	5	13	0.44	11	5	0.31
4	21	0.481	5	14	0.46	11	6	0.32
4	22	0.476	5	15	0.50	11	7	0.31
4	23	0.512	5	16	0.50	11	8	0.31
4	24	0.491	5	17	0.41	11	9	0.35
4	25	0.482	6	1	0.508954	11	10	0.33
4	26	0.494	6	2	0.503617	11	11	0.38
4	27	0.487	7	1		11	12	0.40
4	28	0.488	7	2		12	1	
4	29	0.482	7	3		12	2	
4	30	0.490	7	4		12	3	
4	31	0.513	7	5		12	4	
4	32	0.490	7	6				
4	33	0.494	7	7				



**Figure A57.** All Hf concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A58** All data reported for CUP-2 Ta concentration. Data precision as laboratory reported.

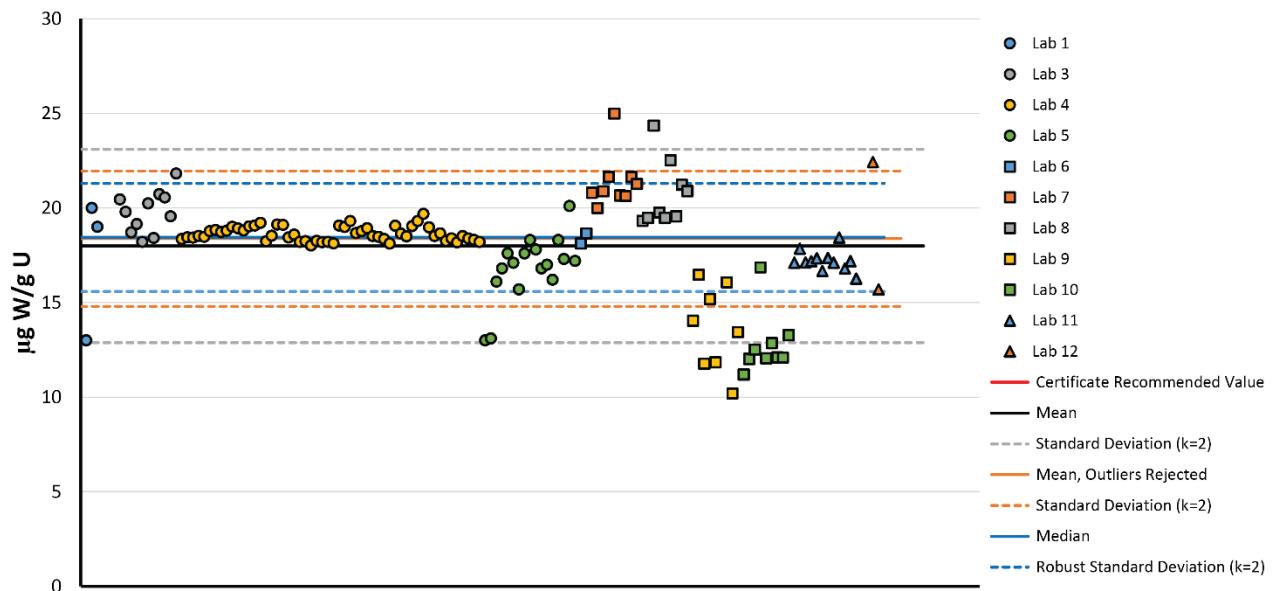
Lab #	Sample #	[Ta] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ta] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ta] ( $\mu\text{g/gU}$ )
1	1	4	4	34	0.080	7	8	
1	2	0.05	4	35	0.086	7	9	
1	3	0.04	4	36	0.086	8	1	0.121
3	1	0.03	4	37	0.084	8	2	0.118
3	2		4	38	0.082	8	3	0.103
3	3		4	39	0.085	8	4	
3	4		4	40	0.085	8	5	0.177
3	5	0.01	4	41	0.086	8	6	
3	6	0.03	4	42	0.084	8	7	0.181
3	7	0.05	4	43	0.082	8	8	
3	8		4	44	0.084	8	9	
3	9	0.03	4	45	0.081	9	1	
3	10	0.03	4	46	0.081	9	2	
3	11		4	47	0.079	9	3	
4	1	0.093	4	48	0.081	9	4	
4	2	0.088	4	49	0.081	9	5	
4	3	0.088	4	50	0.079	9	6	
4	4	0.087	4	51	0.082	9	7	
4	5	0.087	4	52	0.080	9	8	
4	6	0.080	4	53	0.078	9	9	
4	7	0.082	4	54	0.082	10	1	
4	8	0.081	5	1		10	2	
4	9	0.079	5	2		10	3	
4	10	0.085	5	3		10	4	0.05
4	11	0.084	5	4		10	5	
4	12	0.078	5	5		10	6	
4	13	0.086	5	6		10	7	
4	14	0.083	5	7		10	8	
4	15	0.083	5	8		10	9	
4	16	0.080	5	9		11	1	0.03
4	17	0.080	5	10		11	2	0.03
4	18	0.078	5	11		11	3	0.04
4	19	0.080	5	12		11	4	0.04
4	20	0.081	5	13		11	5	0.04
4	21	0.078	5	14		11	6	0.04
4	22	0.078	5	15	0.06	11	7	0.04
4	23	0.080	5	16		11	8	0.04
4	24	0.078	5	17		11	9	0.04
4	25	0.079	6	1	0.049956	11	10	0.04
4	26	0.076	6	2	0.043568	11	11	0.05
4	27	0.076	7	1		11	12	0.05
4	28	0.077	7	2		12	1	
4	29	0.084	7	3		12	2	
4	30	0.084	7	4		12	3	
4	31	0.088	7	5		12	4	
4	32	0.086	7	6				
4	33	0.083	7	7				



**Figure A58.** All Ta concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A59** All data reported for CUP-2 W concentration. Data precision as laboratory reported.

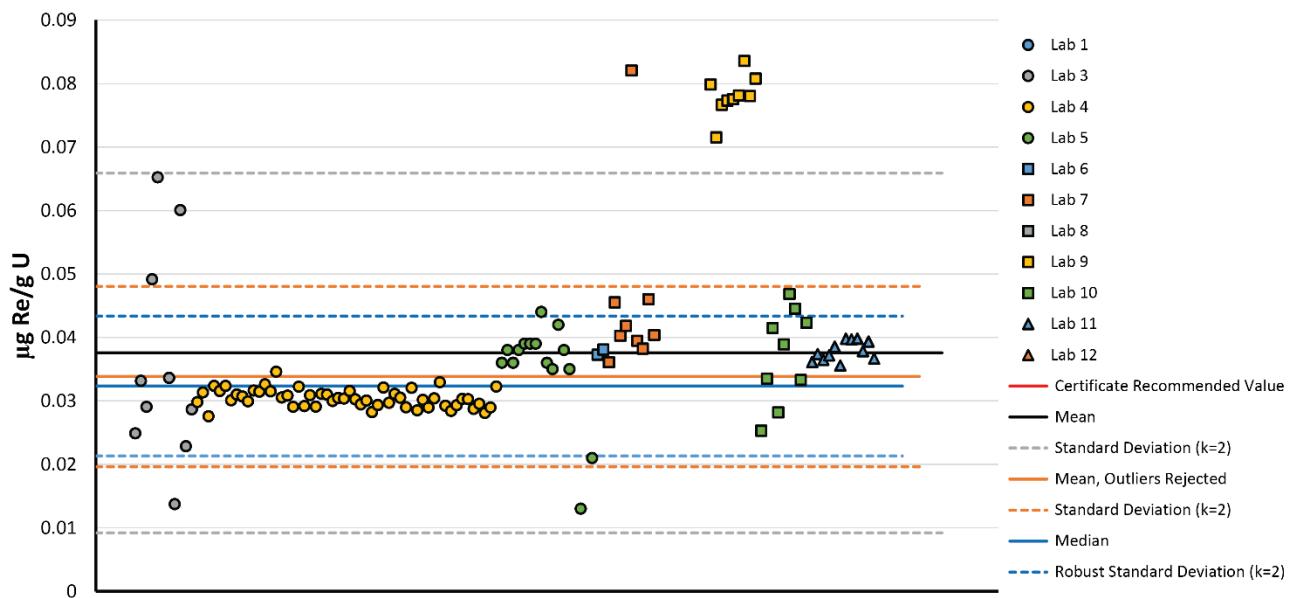
Lab #	Sample #	[W] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[W] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[W] ( $\mu\text{g/gU}$ )
1	1	13	4	34	18.927	7	8	21.6361
1	2	20	4	35	18.513	7	9	21.2647
1	3	19	4	36	18.480	8	1	19.3
3	1	20.4	4	37	18.352	8	2	19.5
3	2	19.8	4	38	18.113	8	3	24.4
3	3	18.7	4	39	19.057	8	4	19.8
3	4	19.1	4	40	18.643	8	5	19.5
3	5	18.2	4	41	18.493	8	6	22.5
3	6	20.2	4	42	19.037	8	7	19.6
3	7	18.4	4	43	19.303	8	8	21.2
3	8	20.7	4	44	19.682	8	9	20.9
3	9	20.6	4	45	18.975	9	1	14.039
3	10	19.6	4	46	18.513	9	2	16.466
3	11	21.8	4	47	18.656	9	3	11.767
4	1	18.353	4	48	18.254	9	4	15.181
4	2	18.446	4	49	18.388	9	5	11.841
4	3	18.430	4	50	18.176	9	6	
4	4	18.519	4	51	18.512	9	7	16.064
4	5	18.472	4	52	18.387	9	8	10.195
4	6	18.767	4	53	18.306	9	9	13.436
4	7	18.839	4	54	18.201	10	1	11.19
4	8	18.722	5	1	13.0	10	2	12.01
4	9	18.801	5	2	13.1	10	3	12.51
4	10	19.006	5	3	16.1	10	4	16.86
4	11	18.922	5	4	16.8	10	5	12.05
4	12	18.809	5	5	17.6	10	6	12.85
4	13	19.032	5	6	17.1	10	7	12.10
4	14	19.063	5	7	15.7	10	8	12.09
4	15	19.216	5	8	17.6	10	9	13.28
4	16	18.236	5	9	18.3	11	1	17.11
4	17	18.527	5	10	17.8	11	2	17.85
4	18	19.119	5	11	16.8	11	3	17.12
4	19	19.104	5	12	17.0	11	4	17.18
4	20	18.439	5	13	16.2	11	5	17.34
4	21	18.585	5	14	18.3	11	6	16.66
4	22	18.207	5	15	17.3	11	7	17.35
4	23	18.245	5	16	20.1	11	8	17.10
4	24	18.011	5	17	17.2	11	9	18.43
4	25	18.258	6	1	18.11268	11	10	16.81
4	26	18.185	6	2	18.65014	11	11	17.18
4	27	18.204	7	1	20.8042	11	12	16.26
4	28	18.122	7	2	19.9863	12	1	
4	29	19.069	7	3	20.8797	12	2	
4	30	18.994	7	4	21.6282	12	3	22.43
4	31	19.307	7	5	24.9815	12	4	15.70
4	32	18.666	7	6	20.6584			
4	33	18.767	7	7	20.6220			



**Figure A59.** All W concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A60** All data reported for CUP-2 Re concentration. Data precision as laboratory reported.

Lab #	Sample #	[Re] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Re] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Re] ( $\mu\text{g/gU}$ )
1	1		4	34	0.032	7	8	0.0460
1	2		4	35	0.030	7	9	0.0404
1	3		4	36	0.031	8	1	
3	1	0.02	4	37	0.030	8	2	
3	2	0.03	4	38	0.029	8	3	
3	3	0.03	4	39	0.032	8	4	
3	4	0.05	4	40	0.029	8	5	
3	5	0.07	4	41	0.030	8	6	
3	6		4	42	0.029	8	7	
3	7	0.03	4	43	0.030	8	8	
3	8	0.01	4	44	0.033	8	9	
3	9	0.06	4	45	0.029	9	1	0.080
3	10	0.02	4	46	0.028	9	2	0.071
3	11	0.03	4	47	0.029	9	3	0.077
4	1	0.030	4	48	0.030	9	4	0.077
4	2	0.031	4	49	0.030	9	5	0.078
4	3	0.028	4	50	0.029	9	6	0.078
4	4	0.032	4	51	0.030	9	7	0.084
4	5	0.032	4	52	0.028	9	8	0.078
4	6	0.032	4	53	0.029	9	9	0.081
4	7	0.030	4	54	0.032	10	1	0.03
4	8	0.031	5	1	0.04	10	2	0.03
4	9	0.031	5	2	0.04	10	3	0.04
4	10	0.030	5	3	0.04	10	4	0.03
4	11	0.032	5	4	0.04	10	5	0.04
4	12	0.031	5	5	0.04	10	6	0.05
4	13	0.033	5	6	0.04	10	7	0.04
4	14	0.031	5	7	0.04	10	8	0.03
4	15	0.035	5	8	0.04	10	9	0.04
4	16	0.031	5	9	0.04	11	1	0.04
4	17	0.031	5	10	0.04	11	2	0.04
4	18	0.029	5	11	0.04	11	3	0.04
4	19	0.032	5	12	0.04	11	4	0.04
4	20	0.029	5	13	0.04	11	5	0.04
4	21	0.031	5	14		11	6	0.04
4	22	0.029	5	15	0.01	11	7	0.04
4	23	0.031	5	16		11	8	0.04
4	24	0.031	5	17	0.02	11	9	0.04
4	25	0.030	6	1	0.037274	11	10	0.04
4	26	0.030	6	2	0.038067	11	11	0.04
4	27	0.030	7	1	0.0361	11	12	0.04
4	28	0.032	7	2	0.0455	12	1	
4	29	0.030	7	3	0.0402	12	2	
4	30	0.029	7	4	0.0418	12	3	
4	31	0.030	7	5	0.0820	12	4	
4	32	0.028	7	6	0.0395			
4	33	0.029	7	7	0.0382			



**Figure A60.** All Re concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A61** All data reported for CUP-2 Ir concentration. Data precision as laboratory reported.

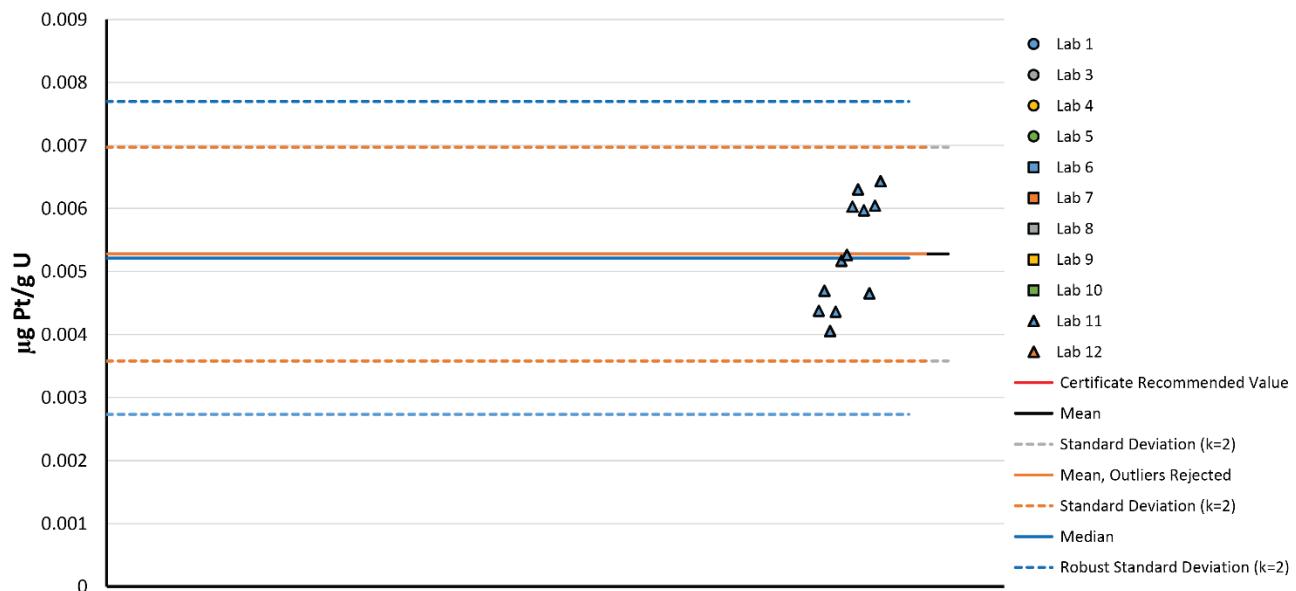
Lab #	Sample #	[Ir] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ir] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Ir] ( $\mu\text{g/gU}$ )
1	1		4	34	0.002	7	8	0.2216
1	2		4	35		7	9	
1	3		4	36	0.002	8	1	
3	1	0.0001	4	37	0.003	8	2	
3	2		4	38	0.002	8	3	
3	3		4	39	0.002	8	4	
3	4	0.0001	4	40		8	5	
3	5		4	41	0.002	8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9	0.0014	4	45		9	1	
3	10	0.0018	4	46		9	2	
3	11		4	47	0.002	9	3	
4	1		4	48	0.002	9	4	1.725
4	2		4	49		9	5	
4	3	0.003	4	50	0.002	9	6	
4	4		4	51	0.003	9	7	
4	5		4	52		9	8	
4	6		4	53	0.002	9	9	
4	7		4	54		10	1	0.01
4	8		5	1		10	2	0.01
4	9		5	2		10	3	
4	10		5	3		10	4	0.01
4	11		5	4		10	5	0.01
4	12	0.002	5	5		10	6	0.05
4	13	0.002	5	6		10	7	
4	14	0.002	5	7		10	8	
4	15	0.002	5	8		10	9	
4	16		5	9		11	1	
4	17		5	10		11	2	
4	18		5	11		11	3	
4	19		5	12		11	4	
4	20		5	13		11	5	
4	21	0.002	5	14		11	6	
4	22	0.002	5	15		11	7	
4	23		5	16		11	8	
4	24	0.002	5	17		11	9	
4	25	0.002	6	1		11	10	
4	26		6	2		11	11	
4	27	0.002	7	1	0.1960	11	12	
4	28		7	2		12	1	
4	29	0.002	7	3		12	2	
4	30	0.002	7	4	0.1389	12	3	
4	31		7	5		12	4	
4	32	0.002	7	6				
4	33	0.002	7	7	0.1334			



**Figure A61.** All Ir concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A62** All data reported for CUP-2 Pt concentration. Data precision as laboratory reported.

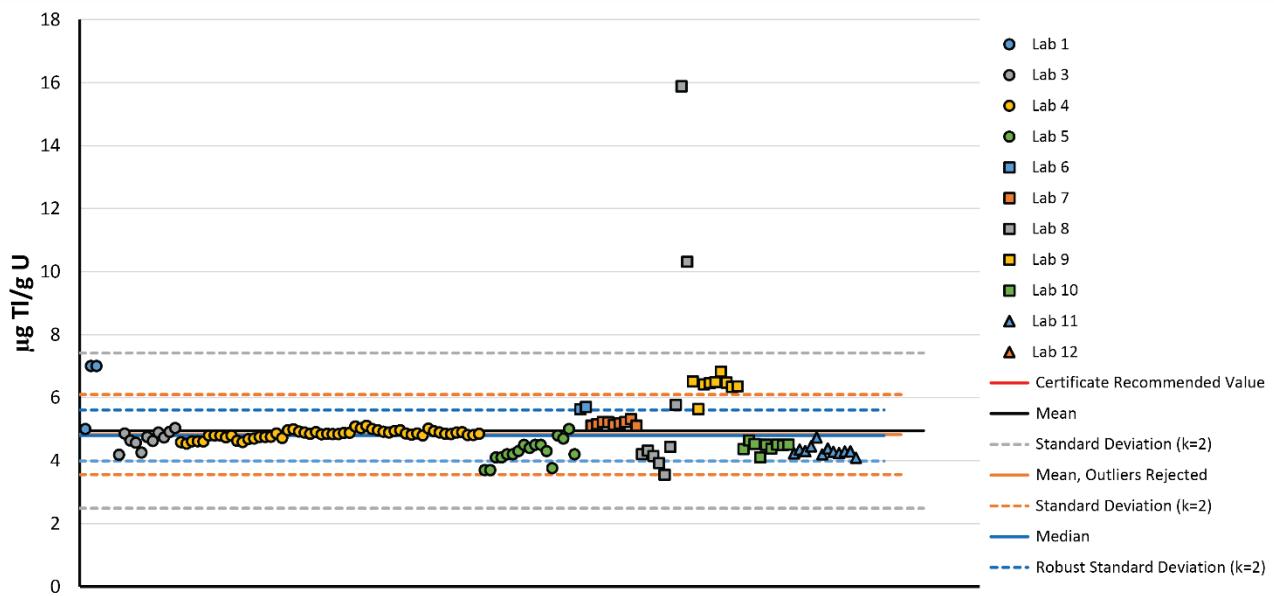
Lab #	Sample #	[Pt] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pt] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pt] ( $\mu\text{g/gU}$ )
1	1		4	34		7	8	
1	2		4	35		7	9	
1	3		4	36		8	1	
3	1		4	37		8	2	
3	2		4	38		8	3	
3	3		4	39		8	4	
3	4		4	40		8	5	
3	5		4	41		8	6	
3	6		4	42		8	7	
3	7		4	43		8	8	
3	8		4	44		8	9	
3	9		4	45		9	1	
3	10		4	46		9	2	
3	11		4	47		9	3	
4	1		4	48		9	4	
4	2		4	49		9	5	
4	3		4	50		9	6	
4	4		4	51		9	7	
4	5		4	52		9	8	
4	6		4	53		9	9	
4	7		4	54		10	1	
4	8		5	1		10	2	
4	9		5	2		10	3	
4	10		5	3		10	4	
4	11		5	4		10	5	
4	12		5	5		10	6	
4	13		5	6		10	7	
4	14		5	7		10	8	
4	15		5	8		10	9	
4	16		5	9		11	1	0.004
4	17		5	10		11	2	0.005
4	18		5	11		11	3	0.004
4	19		5	12		11	4	0.004
4	20		5	13		11	5	0.005
4	21		5	14		11	6	0.005
4	22		5	15		11	7	0.006
4	23		5	16		11	8	0.006
4	24		5	17		11	9	0.006
4	25		6	1		11	10	0.005
4	26		6	2		11	11	0.006
4	27		7	1		11	12	0.006
4	28		7	2		12	1	
4	29		7	3		12	2	
4	30		7	4		12	3	
4	31		7	5		12	4	
4	32		7	6				
4	33		7	7				



**Figure A62.** All Pt concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A63** All data reported for CUP-2 Tl concentration. Data precision as laboratory reported.

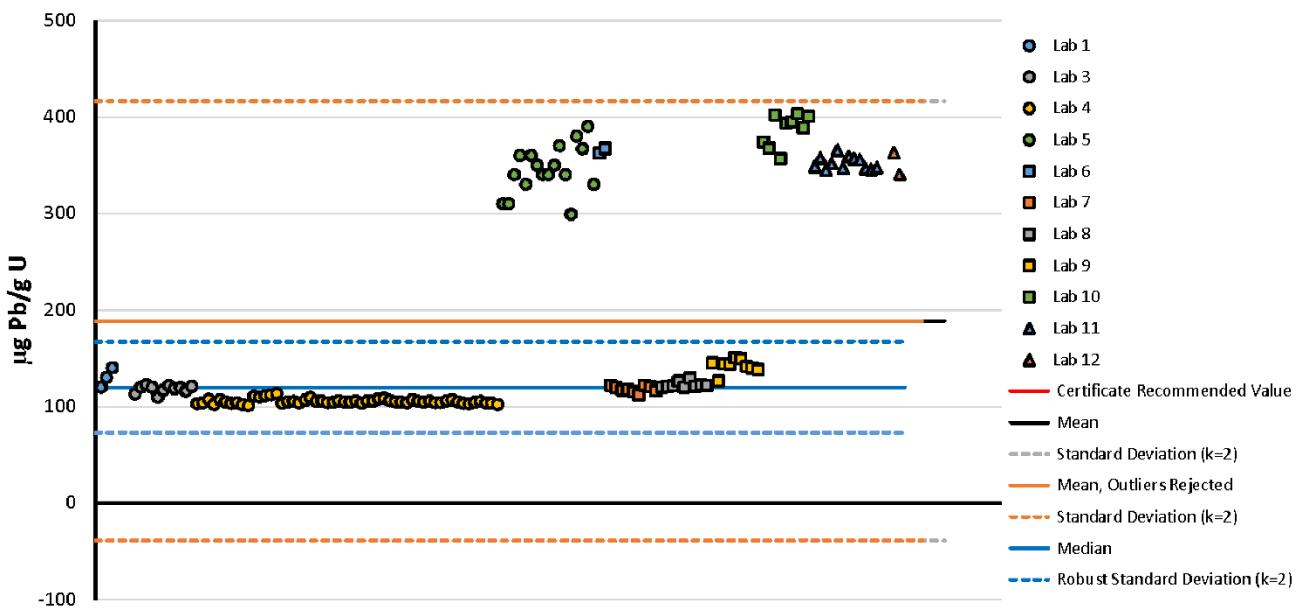
Lab #	Sample #	[Tl] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tl] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Tl] ( $\mu\text{g/gU}$ )
1	1	5	4	34	5.107	7	8	5.3148
1	2	7	4	35	5.001	7	9	5.1078
1	3	7	4	36	4.959	8	1	4.21
3	1	4.2	4	37	4.914	8	2	4.31
3	2	4.9	4	38	4.891	8	3	4.15
3	3	4.6	4	39	4.940	8	4	3.92
3	4	4.6	4	40	4.959	8	5	3.55
3	5	4.3	4	41	4.858	8	6	4.43
3	6	4.8	4	42	4.821	8	7	5.76
3	7	4.6	4	43	4.861	8	8	15.9
3	8	4.9	4	44	4.801	8	9	10.3
3	9	4.7	4	45	5.016	9	1	6.514
3	10	4.9	4	46	4.935	9	2	5.635
3	11	5.0	4	47	4.894	9	3	6.416
4	1	4.585	4	48	4.850	9	4	6.456
4	2	4.538	4	49	4.840	9	5	6.488
4	3	4.609	4	50	4.887	9	6	6.826
4	4	4.612	4	51	4.902	9	7	6.471
4	5	4.604	4	52	4.809	9	8	6.339
4	6	4.793	4	53	4.808	9	9	6.353
4	7	4.794	4	54	4.847	10	1	4.37
4	8	4.791	5	1	3.70	10	2	4.64
4	9	4.740	5	2	3.70	10	3	4.53
4	10	4.796	5	3	4.10	10	4	4.10
4	11	4.630	5	4	4.10	10	5	4.50
4	12	4.586	5	5	4.20	10	6	4.38
4	13	4.681	5	6	4.20	10	7	4.50
4	14	4.700	5	7	4.30	10	8	4.49
4	15	4.751	5	8	4.50	10	9	4.50
4	16	4.750	5	9	4.40	11	1	4.23
4	17	4.756	5	10	4.50	11	2	4.35
4	18	4.858	5	11	4.50	11	3	4.30
4	19	4.719	5	12	4.30	11	4	4.45
4	20	4.962	5	13	3.76	11	5	4.73
4	21	4.997	5	14	4.80	11	6	4.20
4	22	4.922	5	15	4.70	11	7	4.38
4	23	4.890	5	16	5.00	11	8	4.28
4	24	4.852	5	17	4.20	11	9	4.24
4	25	4.903	6	1	5.625355	11	10	4.30
4	26	4.832	6	2	5.697531	11	11	4.29
4	27	4.847	7	1	5.1050	11	12	4.09
4	28	4.838	7	2	5.1556	12	1	
4	29	4.836	7	3	5.2209	12	2	
4	30	4.877	7	4	5.2154	12	3	
4	31	4.881	7	5	5.1354	12	4	
4	32	5.083	7	6	5.1765			
4	33	5.025	7	7	5.2240			



**Figure A63.** All Tl concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A64** All data reported for CUP-2 Pb concentration. Data precision as laboratory reported.

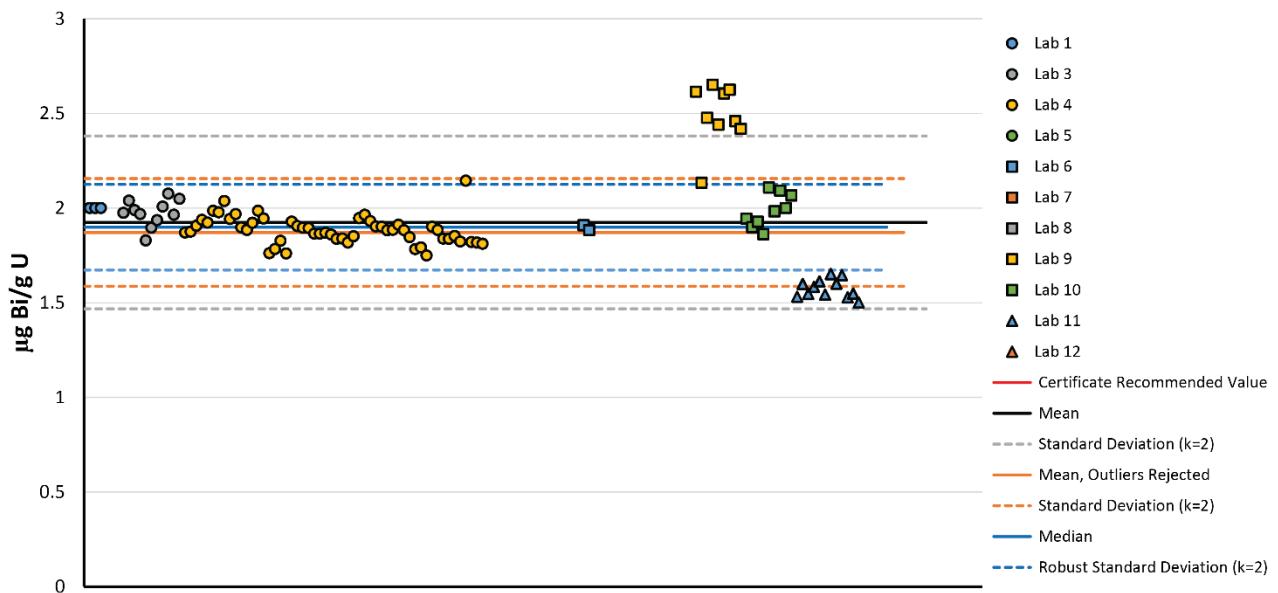
Lab #	Sample #	[Pb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pb] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Pb] ( $\mu\text{g/gU}$ )
1	1	120	4	34	108.512	7	8	120.2466
1	2	130	4	35	106.158	7	9	116.1523
1	3	140	4	36	104.927	8	1	120
3	1	113.1	4	37	104.610	8	2	121
3	2	119.9	4	38	103.974	8	3	121
3	3	122.6	4	39	106.952	8	4	126
3	4	119.9	4	40	105.306	8	5	120
3	5	109.4	4	41	104.562	8	6	130
3	6	117.0	4	42	105.590	8	7	121
3	7	121.6	4	43	104.164	8	8	122
3	8	118.7	4	44	104.126	8	9	122
3	9	119.5	4	45	106.052	9	1	145.253
3	10	116.1	4	46	106.779	9	2	126.259
3	11	120.7	4	47	104.905	9	3	144.295
4	1	103.073	4	48	103.226	9	4	143.822
4	2	103.737	4	49	102.764	9	5	150.305
4	3	107.399	4	50	104.333	9	6	149.444
4	4	102.057	4	51	105.343	9	7	141.287
4	5	106.773	4	52	103.646	9	8	139.942
4	6	104.634	4	53	103.424	9	9	138.245
4	7	103.173	4	54	102.045	10	1	374.36
4	8	103.885	5	1	310	10	2	367.61
4	9	101.911	5	2	310	10	3	401.93
4	10	100.778	5	3	340	10	4	356.60
4	11	110.419	5	4	360	10	5	393.54
4	12	109.965	5	5	330	10	6	395.17
4	13	111.006	5	6	360	10	7	403.30
4	14	112.180	5	7	350	10	8	388.82
4	15	113.488	5	8	340	10	9	400.28
4	16	103.401	5	9	340	11	1	348.70
4	17	104.909	5	10	350	11	2	357.47
4	18	105.178	5	11	370	11	3	344.85
4	19	103.963	5	12	340	11	4	351.86
4	20	106.595	5	13	299	11	5	365.58
4	21	109.255	5	14	380	11	6	346.91
4	22	105.492	5	15	367	11	7	359.30
4	23	105.723	5	16	390	11	8	356.59
4	24	104.194	5	17	330	11	9	355.76
4	25	104.427	6	1	362.8223	11	10	346.37
4	26	105.875	6	2	367.4218	11	11	345.52
4	27	104.811	7	1	121.6160	11	12	347.48
4	28	104.489	7	2	119.5674	12	1	
4	29	105.468	7	3	117.0205	12	2	
4	30	103.665	7	4	117.6524	12	3	363.0
4	31	105.549	7	5	115.3152	12	4	340.4
4	32	105.584	7	6	111.7915			
4	33	107.875	7	7	121.9009			



**Figure A64.** All Pb concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation. Note the means and uncertainties here are calculated from the entire data set and are not reported in the summary tables where total Pb and  $^{208}\text{Pb}$  are reported separately.

**Table A65** All data reported for CUP-2 Bi concentration. Data precision as laboratory reported.

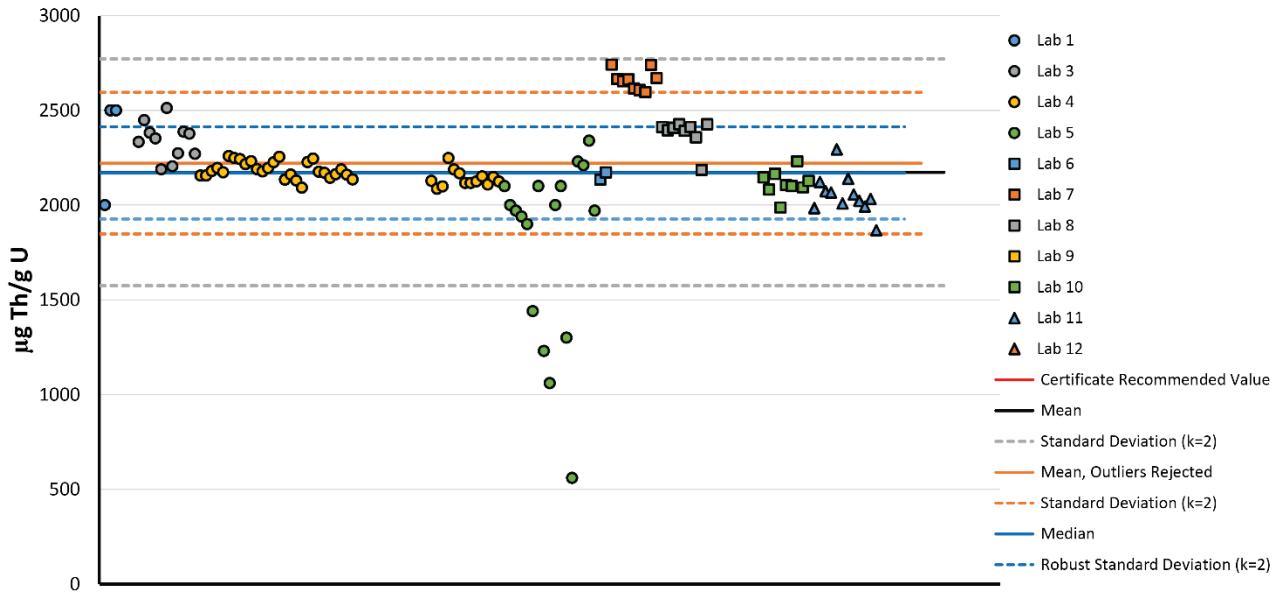
Lab #	Sample #	[Bi] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Bi] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Bi] ( $\mu\text{g/gU}$ )
1	1	2	4	34	1.931	7	8	
1	2	2	4	35	1.903	7	9	
1	3	2	4	36	1.902	8	1	
3	1	2.0	4	37	1.882	8	2	
3	2	2.0	4	38	1.885	8	3	
3	3	2.0	4	39	1.911	8	4	
3	4	2.0	4	40	1.883	8	5	
3	5	1.8	4	41	1.846	8	6	
3	6	1.9	4	42	1.782	8	7	
3	7	1.9	4	43	1.792	8	8	
3	8	2.0	4	44	1.749	8	9	
3	9	2.1	4	45	1.901	9	1	2.614
3	10	2.0	4	46	1.884	9	2	2.133
3	11	2.0	4	47	1.838	9	3	2.476
4	1	1.870	4	48	1.837	9	4	2.651
4	2	1.875	4	49	1.853	9	5	2.441
4	3	1.906	4	50	1.823	9	6	2.605
4	4	1.937	4	51	2.144	9	7	2.625
4	5	1.923	4	52	1.820	9	8	2.459
4	6	1.985	4	53	1.817	9	9	2.418
4	7	1.977	4	54	1.811	10	1	1.94
4	8	2.037	5	1		10	2	1.90
4	9	1.942	5	2		10	3	1.93
4	10	1.968	5	3		10	4	1.86
4	11	1.898	5	4		10	5	2.11
4	12	1.884	5	5		10	6	1.98
4	13	1.922	5	6		10	7	2.09
4	14	1.985	5	7		10	8	2.00
4	15	1.945	5	8		10	9	2.07
4	16	1.761	5	9		11	1	1.53
4	17	1.783	5	10		11	2	1.60
4	18	1.826	5	11		11	3	1.55
4	19	1.761	5	12		11	4	1.58
4	20	1.928	5	13		11	5	1.61
4	21	1.905	5	14		11	6	1.54
4	22	1.896	5	15		11	7	1.65
4	23	1.894	5	16		11	8	1.60
4	24	1.865	5	17		11	9	1.64
4	25	1.864	6	1	1.908879	11	10	1.53
4	26	1.870	6	2	1.882895	11	11	1.55
4	27	1.859	7	1		11	12	1.50
4	28	1.837	7	2		12	1	
4	29	1.838	7	3		12	2	
4	30	1.818	7	4		12	3	
4	31	1.851	7	5		12	4	
4	32	1.947	7	6				
4	33	1.964	7	7				



**Figure A65.** All Bi concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

**Table A66** All data reported for CUP-2 Th concentration. Data precision as laboratory reported.

Lab #	Sample #	[Th] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Th] ( $\mu\text{g/gU}$ )	Lab #	Sample #	[Th] ( $\mu\text{g/gU}$ )
1	1	2000	4	34		7	8	2739.1156
1	2	2500	4	35		7	9	2669.7566
1	3	2500	4	36		8	1	2410
3	1	2333.3	4	37		8	2	2400
3	2	2448.4	4	38		8	3	2410
3	3	2381.3	4	39		8	4	2430
3	4	2352.4	4	40		8	5	2390
3	5	2188.7	4	41		8	6	2410
3	6	2512.6	4	42	2128.089	8	7	2360
3	7	2204.8	4	43	2086.027	8	8	2190
3	8	2273.2	4	44	2098.801	8	9	2430
3	9	2387.0	4	45	2248.049	9	1	
3	10	2376.6	4	46	2188.343	9	2	
3	11	2270.0	4	47	2167.532	9	3	
4	1	2155.397	4	48	2116.555	9	4	
4	2	2155.925	4	49	2116.787	9	5	
4	3	2179.505	4	50	2124.782	9	6	
4	4	2195.153	4	51	2152.100	9	7	
4	5	2172.906	4	52	2108.445	9	8	
4	6	2258.102	4	53	2147.838	9	9	
4	7	2248.331	4	54	2123.852	10	1	2144.92
4	8	2242.764	5	1	2100	10	2	2081.61
4	9	2216.074	5	2	2000	10	3	2164.31
4	10	2231.738	5	3	1970	10	4	1987.27
4	11	2189.404	5	4	1940	10	5	2105.80
4	12	2177.999	5	5	1900	10	6	2100.83
4	13	2195.567	5	6	1440	10	7	2230.27
4	14	2225.796	5	7	2100	10	8	2093.31
4	15	2254.262	5	8	1230	10	9	2127.18
4	16	2134.463	5	9	1060	11	1	1983.74
4	17	2161.106	5	10	2000	11	2	2121.60
4	18	2129.502	5	11	2100	11	3	2072.91
4	19	2091.616	5	12	1300	11	4	2066.40
4	20	2226.882	5	13	560	11	5	2293.44
4	21	2245.138	5	14	2230	11	6	2008.36
4	22	2175.830	5	15	2210	11	7	2137.78
4	23	2169.977	5	16	2340	11	8	2056.71
4	24	2143.194	5	17	1970	11	9	2021.71
4	25	2163.363	6	1	2133.853	11	10	1992.86
4	26	2187.648	6	2	2171.930	11	11	2032.17
4	27	2160.456	7	1	2741.3882	11	12	1867.16
4	28	2135.536	7	2	2664.8490	12	1	
4	29		7	3	2653.7518	12	2	
4	30		7	4	2663.1054	12	3	
4	31		7	5	2614.8613	12	4	
4	32		7	6	2606.8677			
4	33		7	7	2595.2106			



**Figure A66.** All Th concentration data reported for CUP-2. Also shown is the certificate recommended value if available, the mean before and after outlier rejection, the median and associated uncertainties of each average. The lines for the averages and uncertainties extend to different points on the x axis to enable easier differentiation.

